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BULLETIN OF THE

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AN INTERNATIONAL SOCIETY TO PROMOTE THE SCIENCE
AND THE ART OF ADMINISTRATION AND OF MANAGEMENT

A SPECIAL FEATURE

Preprint of Three Chapters from

Copley's "Frederick W. Taylor"

A two-volume biography, to be issued by Harper & Brothers about November 1st, which will present many new facts concerning the origin and development of scientific management.

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BULLETIN OF THE
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AN INTERNATIONAL SOCIETY TO PROMOTE THE SCIENCE AND THE ART OF ADMINISTRATION AND OF MANAGEMENT

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COMMENT

COURTESY of the publishers permits us to print three selected chapters from Copley's "Frederick W. Taylor," which comes from the press this month. Two of these chapters relate to the beginnings of scientific management in the '80s, the other to one of Taylor's later non-industrial researches. Three out of seventy-seven chapters do not give a fair sample of the whole, for no one chapter is complete in itself; but there is enough to indicate that whoever sets out to read the book has an interesting excursion before him. It will provide a new background for a profitable re-reading of the "Principles of Scientific Management" and "Shop Management."

AS the author of this life makes clear, Taylor was not primarily a philosopher and writer. He had two styles; in his speech he was detailed, pell-mell and overwhelming; in his few written papers he deliberately cultivated a compact style and these papers were usually addressed to a particular audience. The result is that those who did not hear him in person expound his philosophy and explain his system, and who are dependent on his written papers, have had difficulty in getting an adequate idea of the scope of his activities, the range of his thinking, and even of that concrete thing known as his system. He was not able temperamentally to dissociate himself from his campaign, objectify his philosophy and the system which expressed it, and write a comprehensive exposition of the whole. That is why this life of Taylor is so important and will for many years undoubtedly be a source of reference concerning the origin, nature and development of scientific management.

REWARDED by indefatigable research, Copley is able to tell the whole story: aspects of Taylor's ancestry and personality which made it inevitable that his life work should be something of the nature it came to be; management methods in the '80s and '90s which made it inevitable, once Taylor was in industry, that his life work should be exactly what it came to be; the step by step building up of a system of management to meet practical conditions which confronted him as gang-boss, as foreman and finally as chief engineer; then his realization of a basic logic in the system as developed and an attempt to formulate the principles involved; finally the struggle to give it to the world by concrete example and by the written word;—the story is told in detail and largely by the use of correspondence from Taylor's unusually complete files and of memoranda which have not heretofore been published.

IT should be remembered, however, that the work was not planned to be a treatise on scientific management, but the story of a man's life. Because the man devoted his life to one continuing purpose, the story necessarily became one primarily of that purpose. But the author's original and constant aim was to portray the man through the incidents of his career, and in that he has succeeded admirably. Elements of weakness as well as of strengh, and incidents of defeat as well as of victory, have been impartially set forth. In no respect is it a conventional biography; it reads more like a novel; it is the drama of a man fighting an environment of which he was a generation in advance;

a fight not without defeats in detail, but with victory in the large. There is a thread of pathos—even of tragedy—running through the whole. The reader, in the light of later events, will be conscious of Taylor's profound influence on the management movement throughout the world; but Taylor himself was hardly conscious of it. He never entertained any thought other than of complete victory in the long run; but he perceived a great closed-mindedness in the industrial world and felt that he had not had the opportunity to more than begin his life's work.

WE have calls for articles in earlier issues of the BULLETIN which are out of print, and this has led us to the decision to reprint such an article occasionally. In this issue, however, we begin by reprinting one article which did not appear originally in the BULLETIN. Mr. Kendall's "Types of Management; Unsystematized, Systematized and Scientific" is as good as when it was presented ten years ago. In fact, the reader can now get more out of it, for he can illustrate Mr. Kendall's points by facts of his own observation during the last decade. There is a general understanding of the difference between unsystematized and systematized management, but even yet too little understanding of the difference between systematized and scientific management. There are probably more executives today than ten years ago who are explaining cases of systematized management as cases of scientific management; and there is certainly a considerable number of "efficiency engineers" who are selling systematized management as scientific management. We hope this reprinting of his earlier article will stimulate Mr. Kendall to prepare another on the same theme in the light of ten years after.

DR. ELIOT ON STANDARDIZATION

THE following article by Dr. Charles W. Eliot, president-emeritus of Harvard University, appeared in several metropolitan papers about the middle of August. The particular copy followed here is that of *The Boston Herald,* August 17.

TENDENCY TOWARDS STANDARDIZATION

A new blight is afflicting education and industries in the United States, particularly the educational part of industries. Its name is standardization, and there is a very general movement to give it application in a great variety of American activities. The blight seems to have started in the industrial domain. To save time and therefore money, and to increase the productiveness of a given plant, the movements of the individual operative were carefully studied with a view to reduce the number of his movements and changes of posture, and to increase the automatic and repetitive quality of his work. The object was larger production at lower cost, and this object was gained; but the inevitable result was the destruction of the interest of the workman in his work. For the lifelong interest of the handworker in the varied products of his skill was substituted the intolerable dullness of tending machinery on a standardized "stopwatch" program.

Soon standardization began to affect the school and college programs, the conditions of admission to college, and the qualification for degrees. It limited injuriously freedom of election of studies in both school and college. It also affected the method of instruction in every school or college course, particularly in the lower or more elementary courses. Thereby, the liberty of the individual teacher, particularly in the lower grades, was restricted, and the expedient liberties of pupils and students were also confined.

It is obvious that standardization has become a dangerous adversary of progress in both education and industry. The ideal in education is to develop the utmost possible variety of individual attainment and of group attainment; just as the true goal of democracy is the free development of the utmost variety of capacity in the individual citizen. Uniformity in the attainment of skill, and therefore in earnings, leads not to joy in work but to discontent and unhappiness in the worker. The true educational goal is the utmost development of the individual's capacity or power, not in childhood and adolescence alone, but all through life. Fixed standards in labor, in study, in modes of family life or of community life are downright enemies of progress for the body, mind and soul of man. That doctrine is as true in churches, courts and legislatures as it is in schools and factories. It is sometimes desirable to suggest minima as respects age, intelligence or productive capacity, but never maxima.

It will be for the happiness of the American people to look carefully into the effects of standardization in both the national education and the national industries. It has already gone too far. Although some pecuniary economies can be effected by standardizing processes in both schools and factories, their physical and moral effects are unquestionably bad. As soon as any process in state or church proves to be injurious to the physical or mental quality of the population a genuine democracy should set to work to modify or suppress it.

The reason that the majority of the American people is today unchurched is that the various Christian denominations or church institutions from the first century to the nineteenth set up fixed standards of belief and practice based on what was supposed to be final revelations. Since experimental science began, about 150 years ago, to contribute powerfully to the progress of mankind, those fixed standards in the church have become discredited among thinking people; but since the religious instinct is universal and irrepressible in man, a diligent search is now going on for a church free from standardization. This search and the co-operative management of the fundamental industries are the most promising efforts of the twentieth century.

CHARLES W. ELIOT.

Northeast Harbor, Me., Aug. 14, 1923.

This impresses us as an example of Homer nodding. Where is the evidence upon which are based such sweeping generalizations?—and by a scholar with the training and traditions of a scientist. Such wholesale generalizations concerning the church appear to be questionable, those concerning education premature, and those concerning industry contrary to available facts.

Dr. Eliot seems to have reasoned as follows: the pre-Reformation church standardized dogma, ritual, belief and conduct, each in greater or less degree; it held these standards rigid until the evolution of thinking, belief and conduct, as a result of actual experience, caused a revolt and set up a new church; this new church established and maintained a rigid standardization until it too was overthrown; and so on. *Ergo:* standardization in the church has been a blight, because it has restrained a more regular and presumably more rapid evolution manifested in a better self-expression of the individual.

But another from a study of the same historic facts might argue: No church, or any other organized social institution (e. g. law) could or can exist except by formulation of guiding standards of purpose, belief, and conduct; standardization makes the existence of human institutions possible; society has learned no other technique of group action; when such standards have been overthrown it is because they have been too inflexible and have failed to conform to gradually developing human experience, intelligence and conduct. *Ergo:* standardization as a principle or a device is not to be condemned, but human ignorance, and imperfection in the use of the principle or device. And then the argument would be developed to show that the modern concept of standardization is that of a "moving equilibrium"; standards subject to intelligent modification.

Consider the matter of education. When Dr. Eliot was a student he was subjected to a highly standardized system of education—rigidly prescribed courses and didactic instruction in accepted opinions and beliefs. Then during the generation of his presidency at Harvard Dr. Eliot was the leader in urging the general acceptance (standardization) of the elective system. Latterly there has been a turn to (standardization) a system less exacting in its prescription of courses than the system of Dr. Eliot's youth, and more exacting in that respect than the Harvard system of his presidency. And accompanying this development of our educational system through these three stages there was a radical and progressive change in methods of instruction in the individual course; the didactic imparting of accepted facts and conclusions giving place to the method of science—seek the facts; analyze, classify and value them; the open mind, take nothing for granted; experiment, research, discussion; and so on.

Who is yet prepared to say which of these three educational systems has produced the better product? Who is prepared to deny that each system achieved or aimed at standardization as the only known method of social trial of the particular educational theory? And who is prepared to deny that we have here a good example of society's learning how properly to use the principle or device of standardization in education, by improving its methods of instruction, thereby converting the standardization of inflexibility into the standardization of progression?

Dr. Eliot attacks standardization in industry as though it were something new, because only recently has industrial thinking given any attention to it. As a matter of fact standardization has dominated machine industry from its beginning, and probably dominated craft industry more than we now realize. The current attention to standardization in industry does not represent an effort to establish standardization as something new, but an awakening to the necessity of improving something very old; an inquiry into the validity of a great mass of standards unconsciously accepted by imitation and tradition, and improvement of the mass by rejection of the elemental standards no longer useful and substitution of new standards proved desirable; the introduction into industry of the principle of that standardization which promotes progress in place of the standardization of inflexibility. *The significant element in the current standardization movement is not standardization itself* (which is a very old thing), *but the questioning of standards* (which is a very new thing), *and the will to establish better and ever better standards.*

To one acquainted with industrial operations—whether general administration, management, or detail execution at machine, bench or desk—it is unnecessary to bring proof that these operations are and for a long time have been highly standardized; represent a great mass of inherited, accepted and unquestioned standards of opinion and procedure. As an example relating to general administration (policy) the discussion at the recent Atlantic City meeting of the American Bankers' Association is a beautiful example of measuring policy by the standards of an earlier generation—no questioning of their present validity. The average executive officer of almost any enterprise presents a picture of intellectual activity in making decisions and physical activity in executing them based on standards derived from—where?—they have just grown up like Topsy! And at machine, bench or desk the method of the workman is a method acquired by imitation without much conscious thought in the process of acquisition.

Scientific management startled the industrial world by declaring it should have standards. What did it mean by declaring it should have that which already permeated all industry? It meant that the standards being used should be tested, rejected where found needless or harmful, and improved where possible; and particularly that industry and every enterprise in industry should provide for the constant, systematic and rational questioning of existing, and the adoption of new and more valid standards.

Standardization is essential to individual and collective functioning, particularly to groups of individuals cooperating for a common result; but it must be rationalized and not unconscious standardization. Standards derived unconsciously by imitation do restrict individuality, but standards adopted through a process of questioning, experimenting and valuing promote individual self-expression. These are the conclusions which must follow observation of facts where rationalized standardization exists in industry.

PROFIT SHARING

Why It Will Not Solve the Difficulties Between Capital and Labor.[1]

I HAVE read through your plan for profit sharing with the very greatest of interest, and have again given a great deal of thought to the whole subject, and wind up where I started, with the firm conviction that the satisfactory and final solution of the difficulties between employers and employes will not be made through profit sharing. I beg to quote you from a paper on "A Piece Rate System," written by me in 1895, as follows, on profit sharing:

> "Co-operation, or profit sharing, has entered the mind of every student of the subject as one of the possible and most attractive solutions of the problem; and there have been certain instances, both in England and France, of at least a partial success of co-operative experiments.
>
> "So far as I know, however, these trials have been made either in small towns, remote from the manufacturing centres, or in industries which in many respects are not subject to ordinary manufacturing conditions.
>
> "Co-operative experiments have failed, and I think, are generally destined to fail, for several reasons, the first and most important of which is, that no form of co-operation has yet been devised in which each individual is allowed free scope for his personal ambition. Personal ambition always has been and will remain a more powerful incentive to exertion than a desire for the general welfare. A few misplaced drones, who do the loafing and share equally in the profit with the rest, under co-operation are sure to drag the better men down towards their level.
>
> "The second and almost equally strong reason for failure lies in the remoteness of the reward. The average workman (I don't say all men) cannot look forward to a profit which is six months or a year away. The nice time which they are sure to have today, if they take things easily, proves more attractive than hard work, with a possible reward to be shared with others six months later.
>
> "Other and more formidable difficulties in the path of co-operation are, the equitable division of the profits, and the fact, while workmen are always ready to share the profits, they are neither able nor willing to share the losses. Further than this, in many cases, it is neither right nor just that they share either in the rpofits or the losses, since these may be due in great part to causes entirely beyond their influence or control, and to which they do not contribute."

I quote this as giving merely a bird's eye view of my study of profit sharing. No single element touched upon by me in these few words is at all satisfactorily treated, and yet I still retain the same views that I had when this was written in 1895.

There are a number of elements which I have not touched upon in this quotation, and which in my judgment form the very essence of the objection to profit sharing. The first of these is that so far as I am able to find out, capital is not, on the average, generally speaking, receiving at the present time more than its fair share of the joint return given to capital and labor. And the eyes of the laboring people are continually directed to the wrong spot when they are focussed upon the great and unjust rewards which capital is now receiving.

I feel very certain that one of the greatest misfortunes under which laboring people now are suffering, is that they are not correctly informed on this very subject. One of the most illuminating articles that I have ever read appeared in the June *Atlantic Monthly*, and was written by Mr. Chas. Norman Fay. It begins on Page 758. I am sending you an extra copy of this number, which I have procured. The apparently reliable statistics given towards the end of this paper constitute, to my mind, its very great value, and show, for instance, that if the entire reward which now goes to capital were divided equally among all the working people of the country, the average head of the family could receive an addition of only 60 cents a day to his wages.

That means that if the entire reward now received by capital were divided equally among all the people in the United States, each individual would receive only 13 cents a day.

Now I have not the slightest idea that the ordinary mechanic or employee of a company knows the facts in this case. He is under the impression, as I was to a large extent, that capital received entirely too large a share of the joint product of capital and labor. (This of course is true, and true beyond the slightest doubt, in the case of certain aggregations of capital throughout the country, but is the exceedingly rare

(*Continued on page* 188)

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[1] A personal letter written by Frederick W. Taylor, August 22, 1922. Reprinted from the Bulletin for December, 1916.

CHAPTERS FROM THE LIFE OF FREDERICK W. TAYLOR[1]

By Frank Barkley Copley

I. ORIGIN AND NATURE OF TIME STUDY[2]

THESE experiments, Taylor told the Special House Committee, were started along a variety of lines. One line was that which has come to be generally known as "motion study" or "time study." Telling how a young man was equipped for this study with a stop watch and ruled and printed blanks, Taylor continued:

> This man for two years and a half, I think, spent his entire time in analyzing the motions of the workmen in the machine shop in relation to all the machine work going on in the shop—all the operations, for example, which were performed while putting work into and taking work out from the machines were analyzed and timed. I refer to the details of all such motions as are repeated over and over again in machine shops. I dare say you gentlemen realize that while the actual work done in the machine shops of this country is infinite in its variety, and that while there are millions and millions of different operations that take place, yet these millions of complicated or composite operations can be analyzed intelligently and readily resolved into a comparatively small number of simple elementary operations, each of which is repeated over and over again in every machine shop. As a sample of these elementary operations which occur in all machine shops, I would cite picking up a bolt and clamp and putting the bolt head into the slot of a machine, then placing a distance piece under the back end of the clamp and tightening down the bolt. Now, this is one of the series of simple operations that take place in every machine shop hundreds of times a day. It is clear that a series of motions such as this can be analyzed, and the best method of making each of these motions can be found out, and then a time study can be made to determine the exact time which a man should take for each job when he does his work right, without any hurry, and yet who does not waste time. This was the general line of one of the investigations which we started at that time.
>
> At the same time, another series of investigations was started which I shall describe later, and which resulted in developing the art or science of cutting metals.
>
> Before starting to describe these experiments, however, I want to make it clear to you that these scientific experiments, namely, accurate motion and time sudy of men and a study of the art of cutting metals,[3] which were undertaken to give the foreman of the machine shop of the Midvale Steel Works knowledge which was greatly needed by him, in order to prevent soldiering and the strife which goes with it, marked the first steps which were taken in the evolution of what is called scientific management. These steps were taken in an earnest endeavor to correct what I look upon as one of the crying evils of the older systems of management. And I think that I may say that every subsequent step which was taken and which has resulted in the development of scientific management was in the same way taken, not as the result of some preconceived theory by any one man or any number of men, but in an equally earnest endeavor to correct some of the perfectly evident and serious errors of the older type of management.

The question as to the extent to which time and motion study was original with Taylor often was raised in his lifetime. His own attitude in this connection was made plain when, in 1912, the Sub-Committee on Administration of the A. S. M. E.[4] dealt with time study in its majority report on "The Present State of the Art of Industrial Management."

To begin with, this committee formulated a basic principle, that of "transference of skill," for all modern industry. By the phrase quoted it apparently meant, first, such a process as takes place when skill to do work is put into a piece of mechanism, and, second, such a process as takes place when best methods of operating machines, handling materials, and so on, are determined in advance by the management and the workman acts in accordance with this predetermination. While making no specific mention of Taylor's work, the committee referred to what Adam Smith in his *Wealth of Nations* (1776) had written about the listing of operations entering into the manufacture of pins, quoted from Charles Babbage's *Economy of Machinery and Manufacture,* and reprinted in the appendix to its report the tables Babbage had presented as those used in France in the eighteenth century and later on in England in connection with the recording and timing of pin-manufacture operations.

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[1] Three chapters from *Frederick W. Taylor* by Frank Barkley Copley. The work, comprising seventy-seven chapters, will be published in two volumes by Harper & Brothers in October. Reprinted here by permission of the publishers. Copyright, 1923, by Harper & Brothers.

[2] Chapter III of Book III, the general title of Book III being "Developing His System at Midvale." The Midvale period was the decade 1880-1890.

[3] It will be seen that these two types of experiments correspond to the two principal sets of detail problems into which his master problem of getting metal cut in the quickest time had divided itself; the one set having to do with the mechanical equipment and the other with the workers' use of that equipment.

[4] Hereinafter the American Society of Mechanical Engineers will be so designated.

From the paper Taylor contributed to the discussion of this A. S. M. E. report we shall quote at length, not only because of its interest in connection with the question of the origin of time study, but also because Taylor here made his most careful attempt to define the nature of this thing which had been so generally misunderstood.

> The historical portion of the report [wrote Taylor] shows careful study, and is evidently the result of much research. In certain particulars, however, it is somewhat misleading; that portion of it, at least, which includes the quotations from Adam Smith, etc., and particularly tables 1 and 2, given in the Appendix.
>
> Although the fact is not specifically stated, still the general impression from reading this part of the report is that "time study," which is the foundation for "the transference of skill from the management to the men," was practically carried on in 1760 and in 1830, as it is now under scientific management. This is, however, far from the truth, and in the interest of historical accuracy it may be desirable to make a statement as to the beginning of "time study," although I realize that questions as to who started time study, and when it was started, are of very little consequence, the important questions being, what is time study? and, how shall we make it more useful?
>
> Time study was begun in the machine shop of the Midvale Steel Company in 1881, and was used during the next two years sufficiently to prove its success. In 1883, Mr. Emlen Hare Miller was employed to devote his whole time to "time study," and he worked steadily at this job for two years, using blanks similar to that shown in Par. 367 of "Shop Management." He was the first man to make "time study" his profession.
>
> It is true that the form of Tables 1 and 2, given in the Appendix to the Committee's report, is similar to that of the blanks recording time study, but here the resemblance ceases. Each line in Table 2, for instance, gives statistics regarding the average of the entire work of an operative who works day in and day out, in running a machine engaged in the manufacture of pins. This table involves no study whatever of the movements of a man, nor of the time in which his movements *should* have been made. Mere statistics as to the time which a man takes to do a given piece of work do not constitute "time study." "Time study," as its name implies, involves a careful study of the time in which work *ought* to be done. In but very few cases is it the time in which the work actually was done.
>
> Previous to the development of "time study" in the Midvale Steel works, there had in all probability been many instances in which men have carefully studied and analyzed the movements of other men, and have timed them with watches. (No such instances have, however, come to my personal attention.) Any such former work was without doubt confined to isolated cases, and was of short duration; and (most important from the historical point of view) it did not lead to the development of a new trade, or, more properly, to a new scientific occupation, "the profession of time study."
>
> Any former efforts of this kind would bear the same general relation to the time study done in the Midvale Steel Works that the many early attempts at flying bear to the work of the Wright brothers. The Wright brothers started "man flying." The Midvale Steel Works started the "profession of time study." (I do not of course intimate that the two developments are of equal importance.)
>
> Time study is the one element in scientific management beyond all others making possible the "transfer of skill from management to men." The nature of time study, however, is but imperfectly understood, and it is therefore important to define it clearly. "Time study" consists of two broad divisions, first, analytical work, and, second, constructive work.
>
> The analytical work of time study is as follows:
>
> *a.* Divide the work of a man performing any job into simple elementary movements.
>
> *b.* Pick out all useless movements and discard them.
>
> *c.* Study, one after another, just how each of several skilled workmen makes each elementary movement, and with the aid of a stop watch select the quickest and best method of making each elementary movement known in the trade.
>
> *d.* Describe, record and index each elementary movement, with its proper time, so that it can be quickly found.
>
> *e.* Study and record the percentage which must be added to the actual working time of a good workman to cover unavoidable delays, interruptions, and minor accidents, etc.
>
> *f.* Study and record the percentage which must be added to cover the newness of a good workman to a job, the first few times that he does it. (This percentage is quite large on jobs made up of a large number of different elements composing a long sequence infrequently repeated. This factor grows smaller, however, as the work consists of a smaller number of different elements in a sequence that is more frequently repeated.)
>
> *g.* Study and record the percentage of time that must be allowed for rest, and the intervals at which the rest must be taken, in order to offset physical fatigue.
>
> The constructive work of time study is as follows:
>
> *h.* Add together into various groups such combinations of elementary movements as are frequently used in the same sequence in the trade, and record and index these groups so that they can be readily found.
>
> *i.* From these several records, it is comparatively easy to select the proper series of motions which should be used by a workman in making any particular article, and by summing the times of these movements, and adding proper percentage allowances, to find the proper time for doing almost any class of work.
>
> *k.* The analysis of a piece of work into its elements almost always reveals the fact that many of the conditions surrounding and accompanying the work are defective; for instance, that improper tools are used, that the machines used in connection with it need perfecting, that the sanitary conditions are bad, etc. And knowledge so obtained leads frequently to constructive work of a high order, to the standardization of tools and conditions, to the invention of superior methods and machines.
>
> It is unusual to make a study such as this of the elementary movements of the workmen in a trade. The instances in which this has been done are still rare. Most of the men who have made what they call "time study" have been contented with getting the gross time of a whole cycle of operations necessary to do a particular piece of work, and at best they have thrown out the time when the workman was idle, or evidently purposely going slow.

Taylor's correspondence reveals that when he stated in the foregoing paper that time study was begun at Midvale in 1881 and that Emlen Hare Miller was employed in 1883 to devote his whole time to it, these dates were fixed from his memory, which we know was usually poor. However, as he went to Midvale in 1878, became a boss in the machine shop late in that year or early in 1879, and quarreled with his men "two or three years" before he resolved to acquire exact knowledge of what was a full day's work for them, the probabilities are that his dates are approximately correct; and to this confirmation is lent by the fact that he stated that his time-study and metal-cutting investigation were started at or about the same time, and in his paper *On the Art of Cutting Metals* we find it printed (page 37) that the first of his metal-cutting discoveries were made in 1881.

At the same time, it is to be considered that, on the basis that "mere statistics as to the time which a man takes to do a given piece of work do not constitute time study," it hardly would be possible for anyone to fix an exact date for the beginning of *true* time study. This because the thing did not spring full panoplied from Taylor's brain, but, as was typical of his revolutionary work in general, was a gradual development from a humble beginning, the manner of it being as follows:

The work of his shop principally was that of machining locomotive tires and car axles, and was repetitive. There was, however, some miscellaneous work; and when the drawing was ready for a new job and an attempt was made to figure its cost, the question arose as to what material would be needed and how long the work would take. Always a fairly accurate estimate could be made as to the material, but when the foreman was called in to settle the time question, all he had to guide him at the best were such records as he might have of the total time it had taken to do former jobs of a more or less similar nature; and it is plain that estimates based on such statistics represented guess work almost pure and simple. Incidentally it was by such guessing also that the foreman right along had set for the workmen a piece-rate in connection with the new job.

Now, few things could have been more abhorrent to Taylor than this guessing; moreover, it eventually "occurred" to him that "it was *simpler* to time with a stop-watch each of the elements of the various kinds of work done in the place, and then find the quickest time in which each job could be done by summing up the total times of its component parts, than it was to search through the time records of former jobs and guess at the proper time and price."[1]

From this it is clear that at the start he had for his object only the improvement of the statistics which long had been used in his shop, and there can be no doubt that for a period he attempted only to record such times as actually were taken. Even here, however, his timing was greatly different from that mentioned by Babbage as having been done in France in 1760. The French observer, one Perronet, simply listed the various processes entering into pin manufacturing (such as straightening and cutting the wire, pointing the pins, and heading the pins), and his timing was confined to recording the gross time it took the workmen to complete each of these divisions of the work, on the basis of lots of 12,000 pins. And when Babbage, seventy years later, got up a new table for English manufacturers, he also contented himself with recording these gross times. On the other hand, it will be seen that from the very beginning Taylor was concerned with timing the *elementary motions* of which individual labor operations consist; which is to say that his work from the beginning lay along the lines of what these days is called job analysis, or the splitting up of jobs into their component parts.

Back of it all was his observation that, no matter how much the jobs coming into his shop might vary, they represented but different combinations of the same elemental motions. If this fact ever had been observed before, it does not appear that it was *deliberated upon* and its significance thus grasped, and in such case the observation was not a real one. What can be affirmed with positiveness is that Taylor was the first to *act* on this fact; that is, really act on it in the sense of pushing the thing through to its logical conclusion.

It will be recalled that when he was at Phillips Exeter, he was profoundly impressed by his observation of the way his professor of mathematics, "Bull" Wentworth, had timed the work of the students in solving various problems, and so was able to give out standard lessons in the sense that he knew how much time the average boy would take to do them. All the indications are that to the extent Taylor was indebted to anyone else for the general idea of timing work, his indebtedness was not to anyone in industry, but, curiously enough, to his old professor of mathematics solely.

At first he did his listing and timing of motions in person, and in connection with the regular work of the shop while the workmen did not know they were being observed. It is probable, in fact, that he began to use a stop-watch in secret while yet he was struggling to force his men to increase their production. It is safe to say also that his first observations were not very elemental, but became more and more so.

Before long he established what one of his associates calls the "unalterable rule that all time study for rate setting must be done not merely with the knowledge but with the cooperation of the worker." As a matter of fact, Taylor's secret use of his watch was fairly feasible only as long as his object remained simply that of improving the statistics long used in the shop in connection with setting piece-rates for and figuring the labor costs of new jobs.

Now he was led from the mere betterment of these statistics into true time study with all its constructive as well as analytical features, is easy to see. As he listed the motions made by his men, he could not well have failed, his mentality being what it was, to observe them *critically*—to question whether they could not be made more deftly and whether they were all necessary. Take any particular motion. If he had not been there with his watch, he would not have been likely to give it a thought; but as he watched the second hand of his watch go around while the worker went through that motion, that motion *loomed up*. All of which is to say that the very process of recording *in detail* the time taken to do work inevitably brings up the question as to whether it is done *efficiently;* that is, whether the same result should not be obtained with less effort, or more result obtained with the same effort.

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[1] *Shop Management*, p. 148.

Obviously such a question can be determined only by experiment; and as Taylor began the experiments which had for their prime object the discovery of false or unnecessary motions, he naturally had to select men for the experiments and fully inform them as to the part they would be called upon to play—certainly in the case of all time *study,* as distinguished from mere time recording, secrecy is impossible.[1] It seems, indeed, that Taylor, when asking permission from his "Uncle William" Sellers to do some experimenting, discreetly mentioned only those of the machine or metal-cutting type, and that for a considerabe period Sellers was unaware of the time study. In this event, however, Sellers probably was the only one connected with Midvale who did not know of the time study when first it really began, and this "blissful ignorance" in his case was made possible by the fact that he came to Midvale but rarely.

It is certain that in inaugurating his time study Taylor did not have the sympathy of a single soul inside or outside of those works. His most intimate friends just sat back and wondered. Says one of those friends, Theophilus B. Stork:

> I can well remember when, at the Midvale Steel Works, he began what seemed to us all at the time a hopeless and useless undertaking, the ascertaining exactly how long it took a workman to do a given piece of work. Imagine a young cadet of industry, a student just out of the technical school, with a stop watch and a huge diagram before him, stationed by Taylor opposite a workman to note minute by minute, aye, almost second by second, each and every movement. Now he takes up a tool; click goes the stop watch, and down on the prepared diagram goes the number of seconds that are required for the movement; and so on, day after day, month after month, until stacks of these diagrams of the time required for the workman to do the simplest act were collected. No wonder many thought the whole work fanciful and its cost of thousands of dollars thrown away.

It was not that there were lacking at Midvale men who appreciated the general idea that if you could find out how long it should take to do a job, you would save endless disputes; but it was thought that in making his minute studies and developing his elaborate records, Taylor again was carrying things to a "crazy" extreme.

To us now there clearly appears in his time study his genius for recognizing that trifles make perfection, or his genius for detail. Such we call it; but in his own philosophy, it was a manifestation, not of genius, but of will. He was likely to be impatient with men who said they had no head for details; he could not help but feel that they simply were too lazy to bother with them.

It would seem that throughout his lifetime it was hard for people both in and out of industry to understand that, regardless of the variety of work done in a shop, the great majority of movements there made are made over and over again, and that when once these movements are standardized, they require no further analysis or timing. Moreover, the whole nature and technic of time study was deliberately and maliciously misrepresented by Taylor's foes. We again quote from the testimony taken by the Special House Committee:

> Mr. Redfield. The statement has been made that it is un-American and an indignity for a workman to submit to time study with a stop watch; that it is annoying and makes a man nervous and irritable. To what extent have you any knowledge as to what extent that is true or not?
>
> Mr. Taylor. Mr. Redfield, I think that the average workman, if any man came to him with a stop watch without any previous explanation or understanding and began timing every motion and writing down what he was doing, would become nervous and would be irritated by it. . . . I am very sure that I should be nervous to a greater or less extent if anyone were timing every one of my motions. I would feel that it was a darn mean job while the thing was going on. But, Mr. Redfield, I wish to call your attention to one fact, which is not at all appreciated: Somehow there has come to be an impression in the minds of people who speak and think of scientific management in its relation to time study, that for every workman who is working in the shop there are probably four or five men standing over him year in and year out with stop watches. Let me tell you that in some of our shops there are many workmen who, in the whole course of their lives, never have a stop watch held on them. And that probably the average man would not be timed for more than one day in his lifetime. So that probably one day of the workman's life would sum up the total of this terrible nerve-racking strain which several of the

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[1] As he reached this stage, Taylor of course studied each labor operation repeatedly before fixing a standard time for it. While doing this he must have found, as time-study men do today, that the worker frequently took different times to make the same motion or perform one of the units to which the operation had been reduced, and for this very reason had his critical attention drawn to that motion or unit. Since it always must impress the observer that there must be a reason why a man takes different times to do the same thing, the most skilful or deft way is indeed most likely to be discovered through the contrasting times of the same unit of an operation as these are presented in a number of studies of that operation.

> men who have testified before our committee have complained of. Therefore, if any man objects to time study, the real objection is not that it makes him nervous. His real objection is that he does not want his employer to know how long it takes him to do his job.

It would appear also that some people think that when you speak of the scientific, you necessarily are referring to something of hair-line accuracy. Thus when it was brought out in investigations of the workings of time study that, in recording such things as the "percentage which must be added to the actual working time of a good workman to cover unavoidable delays," one must depend largely on common sense, there were not lacking those who declared that that showed up the whole thing as unscientific. Taylor, of course, never dreamed of asserting that there was anything exact about time study in the sense that the sciences of mathematics and music are exact. "The whole subject of time study," he told the Special House Committee, "is only an approximation. There is nothing positively accurate about time study from end to end. All we hope to do through time study is to get a vastly closer approximation as to time than we ever had before."[1]

Somewhere along about 1881 it clearly was presented to him that his problem of getting metal cut in the quickest time involved studying both what his men could do and what the machines could do. Hence his two types of experiments; and it is highly probable, by the way, that his machine experiments, or those which constituted a "study of the art of cutting metals," were to a large extent inspired by what he observed while developing "accurate motion and time study of men." Say, for example, you are timing the motions made by a man in lifting a piece of steel to a planer table, in setting it level and true on the table, and in putting on the stops and bolts. Now he starts the planer, and as it works he, occasionally making adjustments, stands waiting for the machine to finih. Doesn't he wait too long? *Can't the machine run faster? Has the cutting tool been ground to just the right angle?* Such questions, at all events, must have occurred to one like Taylor.

As in the case of all men of great achievement, he accumulated his detractors; and one of their ways of attempting to belittle him was by saying that he was a man merely of the machine shop. If they had said *mainly*, their statement might have been true. This aside, Taylor's friends had justification for believing that if his first and great principle of reducing all work to a science could be applied in a machine shop doing any miscellaneous work, it could be applied to anything. "The development of a science," Taylor himself said, "sounds like a formidable undertaking, and, in fact, anything like a thorough study of a science such as that of cutting metals necessarily involves many years of work. The science of cutting metals, however, represents in its complication, and in the time required to develop it, almost an extreme case in the mechanic arts."[1]

Nowadays, thanks to Taylor's investigation, the quickest machine or actual cutting time can be readily calculated. In the early 1880's practically the whole art of cutting metals was left to the individual judgment of workmen and foremen, and thus it necessarily had no basis other than rule of thumb or empiricism. In raising it to an art resting on scientific principles Taylor had to work from the bottom up, and here indeed was an herculean task.

II. FROM EXPERIMENTATION TO STANDARDIZATION[2]

In the notes he sketched for a paper on experimenting, we read further:

> Our experiments have been of two kinds: first, the reduction of the control and operation of machines from rule of humb to science, and, second, the examination and standardization of human actions and work with relation both to maximum efficiency and maximum speed.
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> In changing a machine from rule of thum both in design and in running to a science, first note carefully all the defects of the machine; that is, all things likely to get out of order and cause bad work or stoppage. Next chase down and analyze each defect and note the effect that it has upon the time problem; that is, upon the quantity and the quality of the output. Then centre upon the most important defect and correct it; then follow up in regular order of importance.
>
> Next study all the elements as they affect the speed and output, whether they are connected with the machine alone or with the man and the machine combined; then find the one or more elements which limit the speed of the output; centre on the most important, and correct them one after another. This generally involves a combination of study of the man with the machine and involves in many cases minute time observations with the stop watch.

His time study and his metal-cutting investigation were indeed closely connected and interwoven; having for their common purpose the cutting down of time to the minimum consistent with the doing of good work. In like manner his belting experiments, which were an offshoot of his metal-cutting investigation, had mainly for their purpose the saving of time through the avoidance of delays and interruptions.

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[1] As in the case of other features of Taylor's work, the technic of time study has gone on developing, and this improvement, of course, has been in the general direction of getting results more nearly accurate.

[1] Testimony before Special House Committee.

[2] Chapter VI of Book III, the general title of Book III being "Developing His System at Midvale."

Incidentally we can see this purpose as the general cause of the outpouring of his ingenuity in mechanical invention. His great steam-hammer was designed to work faster than any other thing of its kind. He built a new chimney on top of an old one to save "a loss of at least one or two months in time." And here is the machine-tool table he invented early at Midvale, the table being the part of the machine on which work is placed to be operated on. It usually takes much time to set the work on the table and secure it by clamping, and Taylor just could not stand the spectacle of the machine standing idle while this was being done. So what he invented was a "false" table, or one that was separable from the machine; this, of course, permitting new work to be made entirely or nearly ready on a table while the machine continued busy. Then his study of cutting tools led him to invent a new tool holder further to expedite the work. This, roughly described, enabled a tool to be held in various positions to correspond to various surfaces, and thus made it possible for one tool to take the place of several of different shapes.

In writing about Taylor's metal-cutting investigation at Midvale, Barth says:

> This implied, besides the study of the possibilities of the cutting tools themselves, also a study of the properties of each machine dealt with, in a manner that had probably never been undertaken or thought of before. Through these studies of the machine-tools themselves, Mr. Taylor was able to furnish greatly improved detailed specifications for new machines to be purchased, so that very early in his career he also exerted some influence on the machine-tool building industry, of which I, as draftsman at the works of William Sellers & Company, was made cognizant as far back as the early eighties.[1]

Still another investigation he started at Midvale had for its object the finding of "some rule, or law, which would enable a foreman to know in advance how much of any kind of heavy laboring work a man who was well suited to his job ought to do in a day." His first step was to "look up all that had been written on the subject in English, German, and French," and what he found was that

> . . . two classes of experiments had been made: one by physiologists who were studying the endurance of the human animal, and the other by engineers who wished to determine what fraction of a horse-power a man-power was. These experiments had been made largely upon men who were lifting loads by means of turning the crank of a winch from which weights were suspended, and others who were engaged in walking, running, and lifting weights in various ways. However, the records of these investigations were so meager that no law of any value could be deduced from them.[2]

His purpose was to discover, not what man could do "on a short spurt or for a few days," but "the best day's work that a man could properly do year in and year out and still thrive under." Two first-class laborers, to whom were paid double wages, were selected for these experiments, and for weeks Taylor's time-study man recorded every element connected with their work which was "believed could have a bearing on the result." At Midvale these experiments "resulted in obtaining valuable information," but for the development of the law "governing the tiring effect of heavy labor on a first-class man," Taylor again had to wait until he went to Bethlehem and there had the assistance of Barth.

He deliberated and analyzed and investigated and experimented all along the line. For the qualities of equipment and materials he refused to take the salesman's or the manufacturer's word. When electric lamps were installed at his boring mills, he kept records of the consumption of current of several varieties so that he might determine the most economical.

A thing to be noted about his deliberation is that he did not wait until it was all nicely polished off before he proceeded to experiment. As he was a fallible human being, and so could not determine from the beginning all the knowledge he must seek, his deliberation naturally was subject to a continual process of correction and extension. There, for example, was his original thought that the essence of the problem as to the speed at which cutting tools could be run lay in their shapes and angles; after months of experimenting he learned that this was only one of twelve elements in his speed problem. This illustrates that with any scientist deliberation probably is as much the effect of experimentation as the cause, the one reacting on the other.

In his later years Taylor came to exclaim against the folly of trying to make sure you are *entirely* right before you go ahead. It was his wisdom that you can safely go ahead if only you are sure that your general direction is right—and you should not spend too much time trying to make sure even of that; you at least can proceed with caution. "You learn more with a poor start," he said, "than with no start at all." Evidently this principle of learning through acting governed him as far back as his days at Midvale. It is to be observed, however, that his early-established rule of doing no experimenting himself until he had exhausted all available means of learning what experimenting already had been done in the field concerned was one from which he never deviated.

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[1] Barth's "Supplement to Frederick W. Taylor's 'On the Art of Cutting Metals;'" *Industrial Management,* September, 1919.

[2] *The Principles of Scientific Management,* p. 54.

As his time study or his metal-cutting investigation made it necessary for him to experiment at or with various machines, these machines were withdrawn from the regular work of the shop. This signifies that if he did not actually set up a laboratory, he did what amounted to the same thing. Certainly his was the laboratory *method*. However, nothing like his laboratory ever had been shown before in the sense that its purpose was to determine best shop ways with a view to their standardization. And this brings us to that great principle of his which during his lifetime few people, whether apart from industry or of it, were able to grasp.

From the very outset his principle of standardization appears. He found that the big obstacle to getting the maximum production was the then universal difficulty of rewarding workers equitably according to their accomplishment, and deliberation showed him that at the bottom of this difficulty was the fact that management had "no proper standards for a day's work." Thus it was really to establish proper *standards of accomplishment* (and so be able to set equitable piece-rates) that he began his experiments.

Now, there are jobs where the difficulty of maintaining the desired quality of work is so great that the time element is comparatively negligible, but they are the exception which proves the rule that, because of the relation between speed and economy, a proper standard of accomplishment is fundamentally one of speed or of the time needed to produce work of the desired quality. Hence Taylor's "laboratory" was fundamentally concerned with determining standard times. And that this was a problem possible of solution only by Taylor's method of job analysis should be clear when it is considered that you cannot determine with accuracy the total time a job should take until you resolve it into its elementary operations and time these. Once having determined these elementary times, however, you have data for any new jobs that may come into the shop, since all jobs simply represent different combination of the same elements.

But there is the fact that the time even an elementary operation should take all depends upon the *way* it is performed. This means that to determine the quickest times for adoption as standard, Taylor had to determine the best ways. How could he have done this save through his method of motion study? So there in the "laboratory" was the young man he employed to specialize in this study and the first-class workman who was selected to cooperate with that young man; these two experimenting with all the small details pertaining to the handling of materials, tools, and machine—the lifting to the machine of the metal to be cut; the putting of such tools as drills and reamers into the machine; the measuring with calipers, gages, or scales; the starting of the machine; the changing of the feed or speed; the adjusting of various parts of the machine.

And in the meantime there was Taylor conducting with the help of Sinclair and Gantt the experiments necessary to determine what the actual cutting time of the machine should be. True, he did not get very far with this problem at Midvale; nevertheless, he there succeeded in tracing out laws and getting formulæ and tables which, though crude in the light of the ultimate development, enabled him early to establish standard combinations of feed and speed for certain operations such as the boring and turning of steel tires for locomotive wheels, the net result being a marked reduction in the machine time. And this illustrates, by the way, that the one best way of doing a thing is always relative to time and place, or the existing stage in the development of the art.

But now let us fix our attention on those certain operations. For them Taylor not only had the data which enabled him to determine what the machine time should be, but also the data yielded by his motion study which enabled him to determine what the handling time should be.

So far, all very well. But it is to be observed that these data were developed under laboratory conditions. All the conditions were *under control*. Both the machine and the belting which delivered power to it had been brought up to standard condition and kept there. The cutting tools had been of the same quality of steel, had been subjected to uniform tempering, and had been ground to the same shapes and angles. Likewise the tools used for setting and holding the work in the machine and for measuring it had been of a certain kind and had been kept in a uniformly good condition. Moreover, these tools always had been on hand as wanted, and the same thing was true of the metal which was cut. Finally, there is the fact that the workmen who had cooperated in the time and motion study had been picked out as first-class men for the particular jobs studied, and also had been under control in the sense that, by the offer of an extra wage, they had been induced faithfully to carry out the detailed instructions.

Obviously, then, as Taylor wished to make practical shop use of the data developed in his "laboratory," *he had to exercise in the shop the same control he had exercised in the laboratory.* So now were thrust upon him further problems in standardization as compared with which those involved in determining best ways were simple.

First of all, he had to standardize all the shop conditions—bring them up to the same standard that had obtained in his "laboratory." This made it necessary for him to take the tool grinding and dressing out of the hands of the individual workmen; and as there must be not only standard cutting tools but also standard bolts, clamps, dogs, calipers, gages, scales, dividers, etc., and all these tools must be on hand when wanted so that the workmen would not lose time chasing them up or be forced to resort to tools other than standard, Taylor had to establish a tool room for their systematic care, storage, and issuance. And it also was necessary for him to develop standard practice for such things as caring for the belting and oiling the machines. Certainly it was not until all this standardization work was done that he could begin to make proper use of his metal-cutting and motion-study data.

But just how could he make use of these data? Plainly it involved getting the right materials and the right tools in the right condition to the right man at the right machine with the right instructions *at the right time.* All causes for delay must be guarded against. As far as possible, the flow of work must be continuous. Therefore, *all the work of the shop had to be carefully planned in advance.*

But there was the matter of the instructions. Just as Taylor had found that you cannot determine with accuracy the total time a job should take until you resolve it into its elementary operations and time these, so he now found that to get the job done in that time, he would have to list for the benefit of the workmen the elementary operations that were necessary and the time each should take; which is to say he found that he would have to give his men *detailed instructions in writing.*

It is well known to all executives that it is one thing to give employees instructions and quite another thing to get them to follow the instructions faithfully. And these instructions of Taylor's called for exceptional work—not only for greater continuity of effort but also for a higher order of attention and watchfulness. They thus ran counter to the average man's very human disposition to take things easy. They, in fact, called for a marked and *permanent* change in his habits. Could Taylor, then, have *forced* his men into following his instructions? The fact is that if only because his long fight with his men had taught him a sharp lesson in the limitations of force, he had no idea of attempting such a thing.

We have seen that when he selected workmen to participate in his motion study, he had to enlist their cooperation, their *good will.* Plainly the same principle held good when it came to getting men to work the way the motion study showed they should work. It was not so much a matter of getting them to work harder as of getting them to work *better,* to make all their motions tell.

Even, then, as Taylor had induced men to co-operate in his experiments by offering them an extra wage, so he now offered them an extra wage for following his detailed instructions for the doing of the everyday work of the shop. The principle was that of *exceptional or extra-ordinary wages for exceptional or extra-ordinary work.* If it was a straight engineering proposition, it also was a just one, and for this latter reason alone Taylor would have adopted it, old-fashioned righteousness being a noteworthy part of his heritage.

From the beginning, apparently, he had foreseen that, as he determined what his men ought to be able to do with their equipment and materials, he could pay them higher wages permanently. This indeed, was one of his principal objects. His instinctive belief all along had been that it was for him as a manager to see, not how little he could pay his men, but how much.

Now, as far back as Adam Smith's *Wealth of Nations* (1776) it had been felt that there is a fallacy in the idea that the less there is paid to labor, the less will the product cost; and while in the 1880's it still was far from common for managers to be far-sighted enough to grasp this, more and more were beginning to realize that workmen will not do an extra-ordinary day's work for an ordinary day's pay. However, all those who had been paying extra-ordinary wages had done so in accordance with the philosophy of "initiative and incentive," and it will be seen how different from this Taylor's action became; he paid extra-ordinary wages, ultimately to stimulate the workmen to do more or better work, but immediately to *give them an incentive for maintaining the standards of accomplishment determined by his scientific experiments.*

It now should be recognized that here, coming into being, was an entirely new thing in management, the "central idea" of which, as Taylor came to describe it, was this:

> (a). To give each workman each day in advance a definite task, with detailed written instructions, and an exact time allowance for each element of the work.
>
> (b). To pay extraordinarily high wages to those who perform their tasks in the allotted time, and ordinary wages to those who take more than their time allowance.[1]

But this brings us to the fact that standards of accomplishment for employees will be set in vain, and every possible incentive for maintaining those standards will be given them in vain, unless at the same time there is maintained that standardization of methods, equipment, materials, and general working conditions upon which standards of accomplishment depend. And of all the problems in standardization which confronted Taylor, this one of maintenance was by far the most nicely designed to exhaust his high courage and his superb power of will. If things and persons, once put, only would stay put! If only they did not have that wellnigh universal tendency to sag, lapse, deteriorate, and get out of tune! However, it is unlikely that there ever was a person freer than Taylor from the weakness of repining that things and persons are what they are. He cheerfully adapted himself and his work to the world as he found it, and this, not by any surrender of his ideals, but by resorting to every device necessary to bring his ideals to pass. And it was just in this way that there was brought into existence that complex of methods and mechanisms of management which became known as the Taylor System.

It signifies not merely that standardization inevitably leads to systematization for the reason that without system standards cannot be maintained. It signifies also that *in proportion to the definiteness, determinateness, and high development of your standards must be the definiteness, determinateness, and high development of your system.*

III. BETTER GREENS FOR GOLFERS[2]

THROUGH his enthusiasm for golf and to provide an outdoor sport for the family in general, Taylor converted a rough piece of lawn at Red Gate into an ordinary good putting green. Taking up his permanent residence at Boxly, he determined to have the best possible green, and one with unique features.

Fifty feet by forty, and situated in the garden at the front of the house, this latter green was laid out according to blue print so as to have a "rolling" surface, or one of knolls and depressions. The idea, of course, was to create a greater scope for skill. Designed just for a putting game, the Boxly green has on its sides twelve disks marking the points from which you start to approach the cup with the ball. The cup is so situated away from the centre as to make the lines of approach vary in length, and cunningly calculated do you find the knolls and depressions to assist in making each line present a different problem. After many experiments it was decided to give the green a grade of three per cent.

Greens with rolling surfaces derived from the natural contour of the ground have, of course, long been in use; but our information is that, laid out in 1904, the Boxly green probably was the first one, at least in this country, to have a rolling surface specially planned. Since then Robert Bender has made rolling greens for new golf courses at Whitemarsh, near Philadelphia, at Pine Valley, New Jersey, and at Asheville, North Carolina; and so popular have they now become that on many old courses they have been substituted for flat greens.

When he started to grow grass on his Boxly green, Taylor again followed his principle of not attempting anything original until he had mastered what at the time was considered the best practice. He consulted the best grass experts available, and for no less than three years, while using a "good rich garden soil," followed their general methods.

> Up to the time that the writer [Taylor] started his experiments in the making of a putting green, the best practice consisted in chemically analyzing the soil where the putting green was to be made, and attempting to supply it with the fertilizer and the manure or lime needed to put it in proper condition for growing grass. The soil was then plowed up, the green graded so as to have the proper contour, and the grass was planted—just as grass had always been planted—carefully sprinkling the seeds over the surface of the ground and either gently raking them into the ground or covering them with a thin sprinkling of dry soil and rolling lightly so as to bring the seeds into close contact with the soil.[1]

It also was the practice to sow a variety of seeds to meet the varying conditions, not only on the different greens of a course, but on different parts of the same green. That is to say, the object was to plant a sufficient variety of seeds to make sure that all parts of the green would be covered with grass, whether the soil were "dense or open, moisture-holding or dry, deep or shallow, lean or well supplied with plant food"; one kind of grass flourishing under conditions that another kind finds insupportable. And Taylor added:

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[1] *On the Art of Cutting Metals,* pars. 2-3.

[2] Chapter IV of Book VI, the general title of Book VI being "Serving the Public Without Pay."

[1] This quotation and others in this chapter are from Taylor's article "The Making of a Putting Green," published in five installments in 1915 in what was then *Country Life in America.*

> Another reason for sowing a variety of grasses in a green (and this fact is appreciated by very few people) is that some of the grasses are very slow in maturing while others are in their prime during the first year. For example, the very finest of all grasses for making a putting green in a moderately warm climate, creeping bent (*Agrostis stolonifera*), as *ordinarily planted* requires from three to eight years before it reaches the full stage of development in which it represents almost the ideal putting green grass; and in the meantime some other grass is needed to cover the green properly while the creeping bent is in process of development.

For three years he followed, not only what experts considered the best general methods of preparing the soil and selecting and sowing the seeds, but also what they considered the best general methods of caring for and treating the growing grass. But though we may be sure he followed their methods with rare intelligence, each of the three years brought him a disappointment. At first he attributed his lack of success to not having the right manure and fertilizer, and to a failure to water properly.

> For several years [says Van du Zee] Dr. Taylor worked with all his ingenuity to make the green a success. The injured places were cut out and refilled with a different soil, then seeded with much care. At another time when the grass seemed below par, holes were punched with a steel dibble and filled with bone meal, topped with a germinating mixture. Other carefully thought out efforts were made to get good grass. All these efforts were carefully watched, but the watching did not help.[1]

It should be understood that Taylor was using only the seeds of the "finer, more delicate grasses suitable for a putting green." Eventually he was made to realize that the principal cause of his failure was his "good rich garden soil," which was "unsuitable for growing fine grass, because its grain composition did not permit the grass roots to penetrate as they should, and because its moisture-holding properties were wrong." This fact, however, he had to learn through his own experiments. At the end of the three-year period he found that none of the knowledge of grass-growing then existing was of any service in meeting his problem. He wanted a first-class putting green within a comparatively short time, and the general opinion was that it was impossible. Ah, yes, it was impossible. So, of course, he set out with deliberation to get it.

> As is frequently the case [he wrote], what at first started with a few simple experiments opened out finally into quite an extensive investigation, covering many elements, the relative importance of which it would have been difficult for anyone to foresee at the start.

It was an investigation that was carried on for about eight years, or from about 1907 until the time of his death in 1915. In a note prefacing his *Country Life* article, he said:

> Through the whole series of experiments leading up to the preparation of this article, the writer has had the constant co-operation of his friends, Robert Bender and Harold Van du Zee. Without their untiring assistance and work the investigation could not have been carried on. In his writing, therefore, the author stands as the representative of all three.

It was Taylor who directed and supervised the course of the experiments, and furnished the inspiration. It was Bender who, besides contributing his knowledge as an expert gardener, directed the work of the men who performed the manual labor. During Taylor's lifetime about six men were employed to assist Bender with the regular grounds and garden work, but they had nothing to do with the grass-growing experiments. For these experiments Bender had a special force that from time to time ranged between ten and thirty. As for Van du Zee, it was he who laid out the plans of a civil engineering nature, had charge of the seed-germinating and soil tests, and kept the records.

> While the writer must confess [Taylor added] that his principal reason for making these experiments was the pleasure which he derived from the investigation, still, as time went on, and useful results were attained, there came the secondary object of trying to help the golfers of the country to get better putting greens.

As a matter of fact, it was his desire to make his experiments of general service that directly accounts for the scale on which he came to conduct them. We read further:

> Our experiments started in a somewhat desultory way by planting grass seeds in different soils. We soon realized, however, that if the results obtained by us were to be of real use to grass growers outside of the neighborhood of Philadelphia, there was little to be gained by experimenting with natural soils.
>
> It is practically impossible to describe a natural soil so that it can be duplicated in another part of the country. Soils which have been in process of formation for thousands of years are, in most cases, so intricate in their grain composition, their organic and inorganic food contents, their moisture-holding properties, and their penetrability by grass roots, that it is impossible to describe them so that they can be duplicated.
>
> The words "good sandy loam" and "rich clay soil," for instance, are entirely inadequate to indicate whether a soil is suited to growing grass or not. We, therefore, decided to experiment only with soils artificially made by mixing together elementary materials which can be procured in all parts of the world. . . .
>
> Our experiments had not proceeded very far before we reached the conclusion that a putting green could be constructed of materials of this sort, so that a single variety of grass could be made to grow perfectly on all parts of the green, thus securing a degree of uniformity in the resistance of the grass to the ball which was impossible when, as under the old system, several kinds of grass are planted on the same green. In other words, we proposed to find out the particular variety of grass which will produce the finest and best surface for a putting green, and then develop an artificial soil especially suited to growing this grass. Our object became to suit the soil to the grass, not the grass to the soil.

This means that, to make his grass-growing experiments yield results that would be generally useful, he again had to resort to his principle of standardization.

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[1] Paper prepared by Van du Zee for Memorial Meeting at Boxly.

His experiments, in fine, naturally resolved themselves into a search for a standard grass and a standard soil in which to grow it. How thorough he made them will appear from this list, taken from his *Country Life* article, of the subjects he set down for investigation:

> 1. How to germinate the seeds.
> 2. The proper number of spears per square inch which should be germinated in order to devlop grass quickly.
> 3. How to develop the young grass plants with greatest rapidity.
> 4. Kind of soil in which the old roots will thrive best.
> 5. Kind of grasses best for making greens.
> 6. Nature and amount of food used in soil.
> 7. How to water.
> 8. How to mow grass. How soon and at what height.
> 9. How to keep out weeds.
> 10. How to promote rapid deep rooting.
> 11. Soft but firm surface on which ball will bite right in wet or dry weather.
> 12. Effect of adding cover of different kinds.
> 13. How to prevent mildew.
> 14. Rolling, reason for and kind of.
> 15. Worms—how to prevent them.
> 16. The causes for sour soil, and remedies.
> 17. How soil should be packed in placing a green—loose and tight packing.
> 18. Best and most economical methods of preparing, mixing, and placing the materials used in making a green, including study of best apparatus to use for this purpose.
> 19. The most favorable time of the year for planting seeds.
> 20. How best to guard against the ravages of a heavy rain storm coming soon after green is planted.
> 21. Kind of food to add to older grasses—when and how to feed it. (See 6.)
> 22. Worm casts.
> 23. Depth of soil necessary.
>
> The first seven of these subjects have called for the larger part of our study and attention, and of these the investigation of the conditions under which old grass roots thrive best has taken the most time—chiefly, of course, because it was necessary to wait, in most cases, about nine months for the grass to mature before definite conclusions could be reached. It will be appreciated, of course, that many of these elements are so interdependent that a study of one subject must, of necessity, be closely associated with several others.
>
> One of the first principles governing all scientific investigation, however, is that each experiment shall involve only one single change or innovation. And this simple rule has been closely followed by us, although it has, of course, called for a large number of experiments.[1]

We also may quote in part what he wrote of the general methods to which after two years of "rather desultory" experimenting, due to his inability immediately to grasp the problem in all its ramifications, he eventually settled down:

> Small plots of the different soils, whose grass growing properties were to be investigated, were placed side by side in beds so that a glance from one plot to another would detect even small differences in the quality of the grass. The grass on these plots was all treated in the best possible way so as to bring it to the greatest state of perfection before the intense heat of the summer began to cause it to deteriorate.
>
> Having perfected our grass, in order to prove which plot was the best, it was necessary to subject all of them to the most severe conditions to which grass is likely to be submitted by nature; and, as the grass gradually deteriorated under this severe treatment, to note those plots which showed the greatest resistance to adverse conditions.
>
> It is only by subjecting two or more plots of grass to severe and unfavorable conditions that it is possible to definitely decide which is the best. If they are well treated they are all alike.
>
> The two most severe conditions to which grass is subjected by nature is a combination of great heat with drought, or great heat with an excess of moisture. The climate of Philadelphia, owing to its intense summer heat, is therefore especially favorable for making grass experiments. It would be difficult, in fact, if not impossible, in a cool summer climate to successfully conduct grass experiments. . . .
>
> Between the fifteenth of September and the first of November of each year, from 100 to 450 small plots of soil were prepared and sowed with grass seed. For several years past we have adopted 2 x 2 ft. as the standard size of a plot.
>
> Each of these plots contained only one element, affecting the growth of the grass, which we wished to investigate. They were all sowed with red fescue (*Festuca rubra*) seed because, while among dwarf grasses red fescue is one of the finest and most virile in a cold climate, in a hot climate (like that of Philadelphia) it is almost impossible to make this variety of grass live through the summer months if sowed in any ordinary soil; and a grass of this sort (difficult to grow) is needed to emphasize the differences in the soils under investigation.
>
> Our experiments for several years were made in duplicate; one group of plots containing the various soils to be tested being placed in one part of our grass garden, while a second group of exactly similar plots was located at some distance from the first. . . .
>
> From the time the seeds were planted until the following fall, accurate records were kept of all important facts connected with the growth and decline of the grass.

In the paper Van du Zee read at the Memorial Meeting we find some interesting side-lights on these experiments in general:

> I shall never forget from what a simple statement of basis grew up an unfinished work covering several years of unceasing effort. Dr. Taylor's first explanation to Mr. Bender and myself was that grass needs nourishment, root space, air, and moisture—and for the best meeting of these four requirements were carried out many hundreds of growing tests, and thousands of tests of materials, relating to their physical properties, source, cost, etc.
>
> Many of the materials used in the tests were found only after

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[1] This grass-growing investigation may be taken as exemplifying in its thoroughness all the investigating done by Taylor in determining standards. How, on the other hand, an "efficiency engineer" gets his standards is strikingly exemplified by the remarks on potato growing made by Harrington Emerson in his chapter on "Standards" in his book *Efficiency*. "What," says Mr. Emerson, "is the limit of yield of potatoes from an acre of ground in the United States? The average yield per acre over a series of years is 96 bushels. Shall we, therefore, set 100 bushels as standard 100 per cent efficiency? The lowest average in 1907, 65 bushels, occurred in the great agricultural State of Kansas; the highest average was in the desert State of Wyoming, 200 bushels to the acre. The highest average in Wyoming is due to one man, who issued a challenge of $1,000 open to all the potato growers of Colorado, that he would raise on his Wyoming farm more potatoes per acre than anyone could raise in Colorado, provided further that if he won the contest yet failed to raise 1,000 bushels per acre, he would forfeit the whole of the stakes, $2,000, to charity. He won. It is psychology, not soil or climate, that enables a man to raise five times as many potatoes per acre as the average of his own State, ten times as many per acre as the average of the United States, thirteen times as many as the average in the better soil and climate of Kansas. An easily attainable standard of potato raising is therefore not 100 bushels but 500 bushels, which can be called 100 per cent efficiency."

> long and persistent search, involving much correspondence and many expeditions. When the desired material was found, it was likely to be in unsuitable condition, and then came a search for machinery to bring it to condition. Eventually regular agricultural machines were found that served for mixing, for cutting, for grinding, and for shredding at relatively low costs. Gasoline engines of from ten to twenty horsepower were needed for this work.
>
> Every material had to be tested to show its physical characteristics, much in the way sand is tested for use in concrete and filtration work. Nothing was taken for granted about these materials; positive knowledge was sought and obtained as to the size of their particles, their voids [air spaces], and water-lifting capacity.
>
> A novel plan for study was carried out in the fall of 1909. This consisted of a concrete basin about fourteen feet square and sixteen inches deep. The basin was built with small reservoirs for water, and with drain outlets at different heights to control the depth of the water in the soil.

Referring in a letter to the grass grown in this concrete basin, Taylor said:

> A rather spectacular part of my experiment is that I have succeeded in growing a grass which was planted in the month of November, and which went from the first of June till the first of September without having a drop of rain or other moisture come to it from above. A glass cover was put over it to keep the rain off, and it received its water supply from the reservoir below, through the lifting sands which soaked the water up from the reservoir and passed it on up to the roots.
>
> We experimented with lifting sands from all parts of the country, and finally succeeded in finding sand of a particular grain composition which will lift water as high as 48 inches from a reservoir below, and hand it over to the grass roots. Some ordinary sands will only lift water half an inch, some not at all, others all the way between this and 48 inches, depending upon the grain composition of the sands.

Turning again to Van du Zee's paper, we read:

> It was impossible to avoid the feeling that, in carrying on these extensive experiments, Dr. Taylor took joy in putting shop management into the work. There was the precise classification of materials, precisely measured proportions of the various materials that entered into the synthetic soils, precise percentages of water to be supplied, etc. It seemed as if Dr. Taylor had in mind a routing plan for the roots and for the water. In arranging soils of different kinds in layers at various levels, he made provision for the young roots, the maturing roots, and the fully-matured roots.

We learn also from Van du Zee that Taylor's failures, as they enabled him to eliminate certain combinations, were as satisfactory to him as his successes. He often expressed a joy in failure. "If it weren't for our failures," he said, "we would learn so little!"

While he was conducting his experiments he never lost an opportunity to investigate any promising turf that had been formed in the ordinary way. Turf samples were brought to Boxly from many different regions, replanted there, and carefully treated and watched. The results obtained from this work were practically all negative.

Now, as to the outcome of all this experimenting. In his *Country Life* article, Taylor set forth his conclusions and the reasons for them at length. It must suffice here to say that the grasses he selected as standard were red fescue and creeping bent (the former to be used where summers are cool and the latter where summers are hot), and for the growing of these grasses developed three types of synthetic soil. His first type was his costliest and best. His second type he recommended to those who might not wish to go to the expense of the first type; while not so good as the first, he considered it far better than any natural soil. His third type was a cheaper soil designed for sections where clay is difficult to procure and bar sand is available.

The best type of Taylor soil is constructed as follows: At the bottom is a drainage layer of broken stone from three to four inches thick. Above this are two layers of different soils, one three inches thick and the other an inch and a half; these layers being not horizontal but placed one on top of the other at an angle of 45 degrees. Then above these oblique layers are two horizontal layers of different soils, each about an inch thick; and finally a very thin "seed germinating" layer of a still different soil. The materials that enter into these layers in different combinations and proportions are shredded peat moss, powdered bone, cracked bone, powdered limestone, cow manure, clay, and "fibrous peat from the surface of forest soil."

As was indicated by Van du Zee, these various layers are designed to make provision for the grass roots at the various stages of their development. So masterly was the knowledge gained by Taylor of their development that he was able to tell what, at each stage, they would need in the way of space, air, food, and water.

In a note introducing Taylor's putting-green article, the editor of *Country Life* said:

> On November 2, 1914, I went to Philadelphia and examined scores of experimental grass plots, together with three putting greens on the new Sunnybrook Golf Club's course. These last had been sown only five and a half weeks before—and in a late season for sowing grass. The grass was so well developed that the greens could have been played upon even then, and, owing to the peculiar quality of the soil, without the least danger to the tender young blades. On the same course were other greens, sown at the same time in the old way, bearing eloquent testimony to the superior grass, conformation, and surface texture of Mr. Taylor's greens.

Bender tells us that the best of the ordinary greens cost, in those days before the World War, from $600 to $700 each. The best Taylor green (10,000 sq. ft.) cost $2,500. But whereas the ordinary green costs from $100 to $200 a year for upkeep (feeding and seeding), the Taylor green practically abolishes the cost of upkeep; constant feeding and seeding being done away with, and the green needing only to be mowed and watered. The ordinary green, again, has to be watered every few days, whereas the Taylor green has to be watered only once in two or three weeks.

Nearly a year, we are told, is required to bring the ordinary green to a condition where it can be played on; and then, if the desire is to have a green anywhere near first class, several more years must elapse. A Taylor green, on the other hand, not only is ready to play on in about two months, but in less than a year develops into a practically ideal green, owing to the fact that its synthetic soil makes it unnecessary at the start to grow more than one kind of grass, and the single grass which in it can be brought quickly to usable condition is of the best type for putting. In making the greens for the Pine Valley course, Bender began the work on April 4, and the greens actually were used on the following June 10. A Taylor green can be played on after a heavy rain and throughout the winter; in freezing and thawing, the turf rises and falls, not in sections, but as a mass. It is a green of extraordinary flexibility; dig your heel into it, and immediately it springs back. "The more you walk on it," says Bender, "the better." Moreover, it is a green which, consisting of a single kind of grass, favors scientific putting by offering a uniform resistance to the ball.

After pointing out in his article that the object of his experiments became "to suit the soil to the grass, not the grass to the soil," Taylor went on to say:

> The practice of using the soil as it happens to exist where the putting green is to be located, and of adding manure and fertilizer to improve it, has been so universal, however, that most grass growers will look upon as an extravagance the cost of transporting from a distance materials for making a putting green, and will question whether the members of the club would be willing to pay the cost. The writer is convinced, however, that this objection will not long prevail. The success of a golf course and the pleasure of its members depend more upon the condition of its greens than upon any other single element, and where large sums are spent in purchasing land, building a club house, and making roads leading to the club, the money will be forthcoming for making greens which will be perfect within a year rather than to wait for several years while greens are being gradually improved, frequently at great annual expense by adding properly prepared soil on top of the grass, and resowing, so that in the end the green planted on the natural soil costs far more than the artificial green.

Thus here once more we see exemplified the Taylor principle of prudential spending, of royal economy. And now let us consider the thing that inspired these grass-growing experiments of his; namely, his work at golf—and as here used, work certainly is the word.

CONTROL is the central factor in reasoning. It is regulation and control that makes the difference between guessing and thinking. We may draw an analogy from the mechanical sciences. Science can not create energy, it can only guide and direct it. Science did not create the Mississippi River; what it does it to build levees to direct and control its course. The progress of engineering is a constructive process in which instruments are devised as means of regulating natural energies. In this way we control and use the powers of nature which, left to themselves, threaten to overwhelm us. After the same fashion we may say that progress in thinking is an engineering process in which invention and construction, devising and planning, ordering and adjusting, are the main factors. We cannot create the stream of thought any more than the engineer can create the Mississippi. What he can do is to guide the stream. To do this is to think. In emphasizing the factor of control, we define and locate the problem of reasoning. The difference between clear and confused thinking, between guessing and inquiring, is a difference describable in terms of the amount of conscious control we exercise over the flow of our ideas. Do they just flow along following the lines of least resistance, or is there an effort made to order and arrange them with reference to some need or purpose?

In the tide of human affairs there are to be found two kinds of people: Those who float and those who swim. The floater, carried by the current, drifts aimlessly. The swimmer directs his movements toward an end and organizes his energies with reference to a purpose. To think is to swim, not to float; it is to dominate, not to drift. (McClure: *How to Think in Business*, p. 73-74.)

A PRACTICAL PLAN FOR RATING THE EFFICIENCY OF AN OFFICE ORGANIZATION[1]

By W. H. Leffingwell[2]

I. THE DEVELOPMENT OF THE IDEA

THAT the most thoughtful members of our profession should have been seeking for years some generally applicable plan for rating the efficiency of a business in all its departments is a natural and logical result of the practice of scientific management. In industry as in every other field of scientific research, the constant effort is to discover the laws governing facts and to devise an expression of these laws in workable formulae. As a student of office management for many years, my attention has been concentrated upon this feature of industrial engineering.

It is certain that despite all that has been written on the subject, and the many remarkable, profitable examples now existing of scientific management, most owners and managers of business are entirely unacquainted with the possibilities of Taylor principles applied to business. It cannot be maintained that this ignorance is due to a lack of intelligence. In my opinion the fault lies mostly with the proponents of scientific management. We have not succeeded in focussing the attention of executives on these possibilities. We have shown them scientific scraps and fragmentary pictures, remarkable enough in themselves, but carrying little conviction of what science in industry means as a whole. There has been no way, so far, to determine just how far the poorly managed, or even the well managed company, falls behind the high standards attained by a scientifically managed company. Those whom we strove to interest merely judged what was shown them by mental and abstract comparisons, and if the business illustrated were of a different character they failed to make any comparison whatever. They could not and did not measure the differences; we provided them with no general principle of measurement. Our science had not yet developed so far.

Office work, in particular, presented difficulties of measurement for the reason that so many different kinds of work have to be performed and, except in very large companies, the clerks work upon many different tasks daily. The office manager would admit the possibility of scientifically setting tasks in large companies, but he not unnaturally held the opinion that the task of measuring time in small offices was too difficult, and, it may as well be confessed, to this objection there was then no convincing answer.

My first attempt to solve this problem—for many years I had been obsessed with the idea that it was solvable—was by the "Unit of work" method, which was published in August, 1918, in "The Efficiency Quarterly," New York, in the form of an article entitled "The Office Through a Microscope". The method was later outlined in *The Taylor Bulletin,* Vol. VII, No. 1, February, 1922.

A "unit of work" was there defined as the number of pieces or amount of work on a *standardized* operation which could be performed at the standard rate of output in one hour. The ratio between the standard and the actual amount performed was the ratio of efficiency. With this method it was only necessary to keep time on *unstandardized* operations and deduct this time from the working day—the balance was the time spent on standardized operations; then the number of pieces of various kinds of work was counted and converted into "work units" and the efficiency of the clerk on standardized operations could be obtained with very little effort, even if he worked on a dozen different operations in a day.

This method has been used with considerable success since its inception and it really does provide a very good timekeeping method in an office using scientifically set standards, but it is not applicable to others and therefore failed to meet the problem fully. Besides, it dealt with the factor of clerical output only, which I am convinced is but one of the important factors in office management.

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[1] A paper read before the New York Section, The Taylor Society, October 4, 1923.

[2] President, The Leffingwell-Ream Co., Management Specialists, New York.

Later on, in a paper entitled "The Use of a Measuring Stick in the Office," read before the Cost Division of the Rochester Chamber of Commerce in 1921, I outlined a method for a quick, rough and ready estimate of the relative efficiency of an office where most of the work revolved around the handling of an order. The number of clerks whose work was influenced by the volume of orders was first obtained, work not so influenced being omitted from the calculation. This number was multiplied by the number of minutes worked in a day, giving the total number of clerical minutes devoted, directly and indirectly, to orders. Then the average number of orders handled daily was obtained, and this figure divided into the total clerical minutes gave the number of clerical minutes expended in handling one order. The result was startling to almost everyone who tried out this calculation by experiment. The method, of course, was capable of still further division and the "minutes per order" required to write letters, or invoices, or any other operation could be kept in the form of weekly or monthly reports. It may be interesting to know that of the hundreds of figures gathered, the lowest number of clerical minutes per order was thirty and the highest 1,280. It seems almost unbelievable that one office would require more than forty times as much time to handle its orders as another. Of course, any other unit besides an order could be used but the order seemed the most generally applicable. Where this plan fell short was that, like a cost accounting system, it showed how much time was being spent, but gave no certain indication as to whether the record was good or bad. Though a rough and ready method of figuring, it was still some advance upon my first attempt in this direction.

In October, 1922, as a part of the Management Week program of the Taylor Society, The Society of Industrial Engineers and the American Society of Mechanical Engineers, I read a paper before the Chicago group and circulated a leaflet in questionnaire form, entitled "An Analysis of Your Business—By You". This leaflet was published in the *Taylor Bulletin,* Vol. VII, No. 6, December, 1922.

The central idea of this questionnaire was inspired by the report of the Hoover Committee on Waste in Industry, from which thirty-five of the eighty-three questions were taken. The number of inquiries it called forth showed definitely that there was considerable interest in the subject, and this fact determined me to set about the collection and consideration of all the factors necessary for a real solution of this fascinating problem. It proved to be a long and laborious but none the less interesting task.

The result is embodied in our present Examination and Rating Plan which was put into actual operation in April, 1923. We have already had sufficient experience to prove its general applicability and unquestionable value. My experience with the questionnaire previously mentioned showed definitely, at least, that the proper procedure was to begin with one subject—in this case it was naturally Office Management—and to work that out fully, though the general plan was and still is, to measure eventually all phases of management by the same method. Our company now has under preparation a rating plan for the Sales Organization and the Production Organization. This paper, however, deals only with the plan of rating the efficiency of the Office Organization.

II. THE REQUIREMENTS OF A PLAN OF RATING

There are five definite requirements for the construction of any rating plan,—as follows:

1. The factors of the problem must be defined and it must be determined which of these factors are measurable and which are not. Determining the factors of any complex problem is not a simple matter but when this is done, it is even more difficult to determine which of the factors are not measurable. At first thought, most of them seem to be not measurable.

2. The immeasurable factors must be eliminated. No matter how important these immeasurable factors may be, or seem to be, they must be ruthlessly cast out of any rating plan, for it is an obvious waste of time to attempt the measurement of the immeasurable.

3. After the immeasurable factors have been eliminated, a division of the measurable ones must be made. Each subject is divided into its component parts—its elements. This is precisely the method that Taylor used in setting a standard—he found the elemental times and then synthetically built up his standard. Each factor represents a number of variables and each must be considered by itself.

4. Standards for each element must be determined—standards which will progress with the progress of in-

dustry. There are a few things in industry, perhaps, which will always require a stationary, permanent standard for their measurement, but most standards are progressive and in any rating plan nothing short of the Taylor Society conception of a standard should be considered. I quote Morris L. Cooke's *standard* definition:[1]

> A standard under modern scientific management is simply a carefully thought out method of performing a function, or carefully drawn specifications covering an implement or some article or stores or product. The idea of perfection is not involved in standardization. The standard method of doing anything is simply the best method that can be devised at the time the standard is drawn. Standard specifications for materials simply cover all the points of possible variation which it is possible to cover at the time the specifications are drawn. Improvements in standards are wanted and adopted wherever they are found. There is absolutely nothing in standardization to preclude innovation. But, to protect standards from changes that are not in the direction of improvement, certain safeguards are erected. These safeguards protect standards from change for the sake of change. All that is demanded under modern scientific management is that a proposed change in a standard must be scrutinized as carefully as the standard was scrutinized prior to its adoption, and further, that this work be done by experts as competent to do it as were those who originally framed the standard. Standards adopted and protected in this way produce the best that is known at any one time. Standardization practiced in this way is a constant invitation to experimentation and improvement.

5. A method of rating the elements against each of these standards must be devised. Even with a carefully thought out standard to compare with, it will not be found simple to rate the existing conditions, and different elements will require varying formulae.

The elements selected to be rated must be unmistakably basic in character. There will be a great temptation to include the elements of new management technic which the engineer thinks all companies *ought* to use, but which, strange to say, they do not. The fact that many admittedly well-managed companies get along somehow without these things should be a sufficient deterrent—and though the engineer may consider them basic, he will quickly learn that his clients will not. Each component part should be one that is generally recognized as an integral part of *good* management.

The standards against which the elements are rated must be practical and capable of duplication under average conditions and circumstances. World's records and stunt performances must be rigidly eliminated.

The method of examination to discover existing conditions and the rating to determine relative efficiency must be economical. Time is an important element as well as cost; the work must be quickly and, at the same time, thoroughly done. Also the method must be capable of application, without disturbance of either the routine operations or the morale of the workers—it must be systematized and cause as little trouble as an audit of the books.

The relative weighting of the factors and elements presents a puzzling problem at first, though this is not the really important question that it seems. Mitchell says[1] that the real problem in weighting is not to strive after literal exactness but to be conscientious and consistent and particularly to rationalize it and not leave it to chance.

Relative and rational weighting is more important than striving for an exactness which is probably not possible. Let your standards be "carefully thought out," the results of scientific research, and your measurement of existing conditions be accurate, and the exact measure of importance you attach to the item will not matter. For example, our standard on typing letters from shorthand notes is 200 square inches an hour. In one office we found twenty-five stenographers averaging five letters a day. A letter usually averages under fifteen square inches, and the work day was seven hours, therefore these stenographers wrote about 5 per cent of our standard. The management's discovery of this fact was of itself far more important than any figure we might attach to it to represent our ideas of its relative weight. And it was manifest also that the stenographers were not to blame, for no stenographer deliberately writes less than two words a minute or sits idle for more than six hours.

In each element we use a standard which we designate as The Best Known Practice and we define is as follows: The Best Known Practice is that which results in the highest degree of effectiveness attainable by an organization of normal persons. The phrase is not to be understood as signifying a degree of excellence obtainable only by famous experts, specialists, or persons with natural exceptional ability on any particular subject or operation. No "world's record" or anything remotely resembling it enters into the comparison. In short, The Best Known Practice may be defined as a high class result already in practice, which can be duplicated by any normal organization.

It will be seen that this definition accords with the general principle on which standards are to be determined and at the same time provides for a movable standard; as business progresses, the standard will move upward, just as standards of performances of all kinds are progressively raised. It is a remarkable fact also, that while we have found a few instances where the Best Known Practice was equalled, we have not yet found an instance where our standards were shown to be too low—which confirms us in the knowledge that they are really scientific standards. For example, the records of clerical outputs so far have not averaged 60 per cent of our standards, yet each and every standard represents "a high glass result already in practice which can be duplicated by any normal organization."

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[1] *Bulletin No. 5,* The Carnegie Foundation for the Advancement of Teaching.

[1] Bulletin of U. S. Bureau of Labor Statistics. Whole No. 173, p. 72.

III. THE PLAN OF EXAMINATION AND RATING

We have divided the subject of Office Organization into 15 main divisions and 93 subdivisions, as follows:

- I. Arrangement of Office
    - Economical use of space
    - Direct flow of work
    - Adequate light, daylight and artificial
    - Adequate circulation aisles
    - Reduction of preventable noise
    - Adequate ventilation
    - Adequate drinking fountains
    - Adequate cloak rooms
    - Adequate toilet facilities
    - Adequate reception room for public
    - General appearance
- II. Equipment (Desks, etc.)
    - Adequacy for purpose
    - Sufficiency in number
    - Standardized as to size
    - Condition
    - Standardized as to appearance
- III. Use of Office Machinery
    - Best machine for purpose
    - Machinery profitably used
    - Machinery used where necessary
    - Machinery of modern character
- IV. Correspondence
    - Clearness
    - Composition
    - Courtesy
    - Grammatical construction
    - Appearance
    - Production
- V. Filing
    - Economy of space
    - Work up to date
    - Accuracy
    - Value of filed material
    - Sufficient space
    - Adequate systems
    - Adequate custody
- VI. Stockkeeping
    - Economy of space
    - Location system
    - Order
    - Neatness
    - Issuing system
    - Control
    - Classification
    - Storage methods
    - Inventory system
- VII. Intercommunication
    - Telephone service
    - Clerks at desks
    - Messenger system
    - Necessary mechanical devices
- VIII. Forms
    - Economy
    - Effectiveness for purpose
    - Suitable quality of paper
    - Suitable colors
    - Color schemes
    - Uniformity in size
    - Uniformity in color
    - Uniformity in shape
    - Uniformity in typography
- IX. Routines and Methods
    - Routines:
        - Directness
        - Simplicity
        - Uniformity
        - Expedition
    - Methods:
        - Effectiveness
        - Simplicity
        - Uniformity
- X. Clerical Output
    - Quantity performed
    - Division of labor
    - Interruptions
- XI. Control of Output
    - Uninterrupted flow of work
    - Scheduling
    - Handling peaks
    - Working force well balanced
    - Adequate planning
    - Adequate records or reports
- XII. Salary Standards
    - Salaries not unnecessarily high
    - Standard salaries for similar positions
    - Salaries not below market
- XIII. Turnover of Employees
    - Length of service
    - Rate of turnover
- XIV. Organization
    - Clearly defined lines of authority
    - Functionalization
    - Not too many departments under one head
    - Organization chart
    - Organization write-up
    - Standard practice instructions
- XV. Personnel
    - Progressive records of employees' performance
    - Methods for testing employees' ability
    - Training methods
    - Employment methods
    - Discharging methods
    - Promotion methods
    - Methods for developing employees' versatility
    - Records of reasons for "quits"
    - Plan for determining causes of dissatisfaction
    - Vacation policy
    - Bonus, profit-sharing, or other plans of similar nature

Each of the fifteen major subjects has a maximum value of 100 points. The ninety-three subdivisions or elements of these main topics are weighted in accordance with their relative importance. Naturally some features of office practice are a great deal more important than others, but as these features are not of equal importance in all lines of business, we have made no attempt to weight the main subjects in accordance with their importance. This fact should be noted.

With respect to each of these subdivisions the number of points which have been deducted from a perfect score is indicated in the summary following an examination. These deductions from each of the subdivisions of a main subject are totalled under that subject and then deducted from 100, the remainder forming the percentage rating on the main subject.

The general rating is then obtained by averaging the ratings for each main subject. It is admitted that this general rating is only approximate, for with our limited knowledge of any particular business which is examined by this method, it is not possible to undertake to give each main subject its relative weighting.

Proper weighting of the subdivisions within the subject is, however, given. The relative weighting of each subdivision is based upon years of careful study and experience, but I do not quote figures upon it here, as I recognize only too well that this weighting is not necessarily final. Only after we have had an experience in actual rating covering years and including hundreds of examinations will it be possible to announce authoritatively the relative importance of each subdivision. In the meantime I do not wish to subject the matter to premature criticism of details while it is in the early stage of development.

The basis and detail of the entire plan is covered in our Method of Rating book which we use as our standard practice procedure. The general method of making the examination and rating is as follows:

The field examiner goes to the office and begins his examination in a logical and sequential manner, with the aid of a carefully standardized questionnaire. This questionnaire is most complete and thorough—in extent it covers some fifty pages of typewritten matter—its purpose being to determine as far as may be possible the exact conditions on each of the 93 subdivisions. The same questions are asked of all offices.

Following this collection of data by information, there is a series of observations and measurements to be made: the lighting is measured; the space is measured; the filing cabinets are examined and measured, the filing material being examined and counted for accuracy and other qualities; the clerical output is measured; and so forth. Besides this, each clerk and executive supplies the examiner with certain other information required. The examination is most minute and thorough, and at its conclusion, the answers given by the executives are submitted to them for approval and in some cases for signed verification.

The data secured by the field examiner are then brought to the office and studied in conference with specialists before the various items are rated. The rating of each subject involves the use of a definite formula as will be shown later. Judgment does not enter into the matter at any point—facts found are compared with standards and measured according to a predetermined procedure.

So far, the "patient" has been subjected to a thorough examination and his physical business condition determined. But, as the client has the same human curiosity as any other person being examined and wishes to know why he is rated as he is, a thorough explanation of the conditions found and the defects embodied in them is prepared.

This summary of findings takes up each one of the points studied, states the condition found, gives a comparison with the "Best Known Practice," explaining what that practice is, and offers where necessary, concrete suggestions for the improvement of existing conditions. This complete presentation furnishes a valuable and accurate picture of such conditions and enables the management to see just where the organization is strong and where it is weak.

To further assist the executive in visualizing and following through on all the suggestions given, a Checking Sheet (Fig. 1), is prepared on which each suggestion listed is given by number and restated in a condensed form. On this sheet he can make any written comment he desires and also mark down the name of the individual to whom he decides to assign the suggestion.

IV. THE VALUE OF THE PLAN

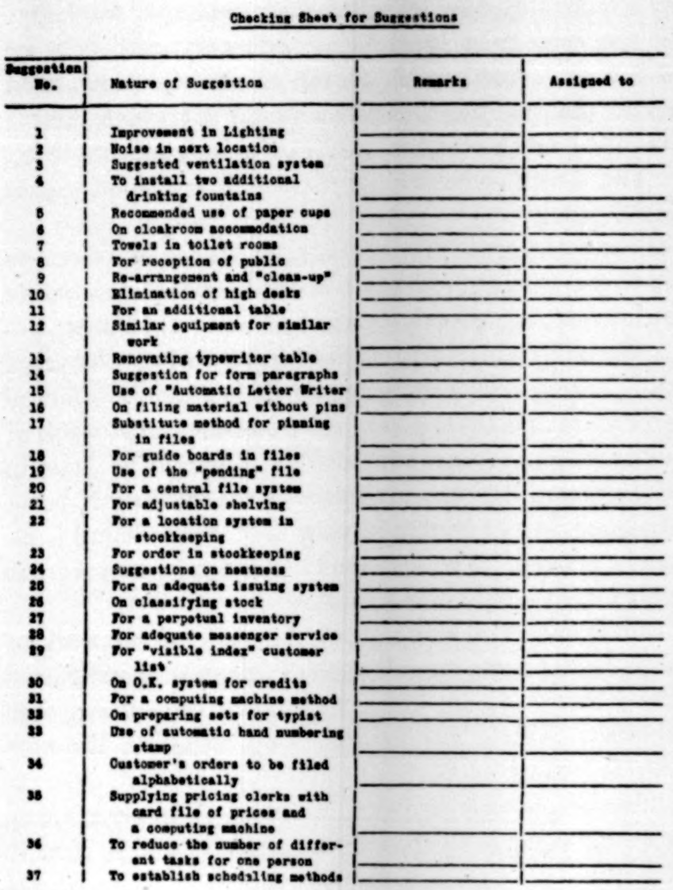
Experience warrants the statement that this plan possesses a great and constantly growing value.

First; it furnishes a measurement of present conditions (by a distinterested organization) in comparison with a definite standard which is known to be attainable.

Second; it provides a successful executive with the oportunity of proving his success to the management by disinterested testimony.

Third; if such an examination is made periodically it furnishes a definite measure of progress.

Fourth; the thorough nature of the examination invariably discloses waste even in a well-conducted organization, and such waste is usually discovered where its existence was not suspected by the management.



Checking Sheet for Suggestions

Suggestion No.	Nature of Suggestion	Remarks	Assigned to
1	Improvement in Lighting		
2	Noise in next location		
3	Suggested ventilation system		
4	To install two additional drinking fountains		
5	Recommended use of paper cups		
6	On cloakroom accommodation		
7	Towels in toilet rooms		
8	For reception of public		
9	Re-arrangement and "clean-up"		
10	Elimination of high desks		
11	For an additional table		
12	Similar equipment for similar work		
13	Renovating typewriter table		
14	Suggestion for form paragraphs		
15	Use of "Automatic Letter Writer		
16	On filing material without pins		
17	Substitute method for pinning in files		
18	For guide boards in files		
19	Use of the "pending" file		
20	For a central file system		
21	For adjustable shelving		
22	For a location system in stockkeeping		
23	For order in stockkeeping		
24	Suggestions on neatness		
25	For an adequate issuing system		
26	On classifying stock		
27	For a perpetual inventory		
28	For adequate messenger service		
29	For "visible index" customer list		
30	On O.K. system for credits		
31	For a computing machine method		
32	On preparing sets for typist		
33	Use of automatic hand numbering stamp		
34	Customer's orders to be filed alphabetically		
35	Supplying pricing clerks with card file of prices and a computing machine		
36	To reduce the number of different tasks for one person		
37	To establish scheduling methods		

Fig. 1. Checking Sheet.

Fifth; the suggestions which we are able to offer serve to direct the attention of the management to the further possibilities of improvement along scientific lines.

Sixth; as the examination proceeds there is developed a psychological factor which has a most helpful effect on the morale of the organization from top to bottom. Defects which on the surface appear to be the fault of an individual, are by this examination often shown to be the fault of the organization. Employees are only too glad to have our defense of their position. Where favoritism exists, the examination shows up its effects glaringly. Executives of the right sort are eager to take advantage of the suggestions offered. At the conclusion of the work, the whole organization has received a powerful stimulant to improvement.

V. THE METHOD APPLIED

To explain the method I shall give an illustration of each step of the work, using as examples elements of three of the fifteen main divisions: I. Arrangement; V. Filing; XI. Control of Output. To cover the whole subject would be impractical as there are a total of 93 subdivisions, and a finished examination usually covers over 20,000 words.

The information required for the rating is obtained in three ways: 1. By direct questioning. 2. By observation. 3. By measurement. The questions which follow are only a few necessary to explain the method. They are taken from the records of actual cases:

I. ARRANGEMENT OF OFFICE: ECONOMICAL USE OF SPACE

A. Field Examiner's Questions and Replies

Are there any private offices which are unnecessary? *No.*

Should private offices be provided for any executives who do not now have them? *No.*

What is the total net area of the office, including stock rooms, vaults, private offices, etc. *23,903 square feet.*

State the area of:

a.	Reception space	
b.	Vaults	600 sq. ft.
c.	Stock rooms	1,875 sq. ft.
d.	Filing dept.	3,000 sq. ft.

B. Office Rating Sheet

a.	No. of executives with private offices.......	18
b.	No. of executives with private offices who do not need them	0
	a — b..................................	18
c.	No. of executives without private offices who should have them	0
d.	a — b + c..............................	18
e.	No. of clerks last clerical payroll..........	143
f.	Allowance for storage space..............	4,875
g.	100 d + 50 e + f = ...	13,825
h.	Total net area	23,903

Explanation: g equals the space required. Item d shows that there are 18 executives who require private offices or space equivalent. According to the best known practice, an allowance of 100 sq. ft. must be made for each executive. There are 143 clerks, item e., who require 50 sq. ft. each. Allowance in this case must be made for 4,875 feet of storage space. Therefore, the total space required is 13,825 sq. ft.

The total points allowed for Economical Use of Space, out of 100 points allowed Arrangement, is 22. Therefore the formula:

$$\text{Deduct } \frac{22\,(h-g)}{h} \text{ points if } h \text{ is more than } g. \quad 9.5 \text{ points.}$$

$$\text{Deduct } \frac{22\,(g-h)}{g} \text{ points if } g \text{ is more than } h.$$

That is, we penalize them if they have more space than is required, or if they have less space than they need.

C. Summary of Findings Reported to Client

The elements of the arrangement of a business office are based first and foremost on its conducing to the proper service of customers, whether these transact their business in person or by letter. This is the most important consideration. Second, though also of great importance, is the economical use of the space occupied —the installation of the equipment, desks, tables, files, machines, etc. Third, arranging them most conveniently for the operatives and the work to be done on, at, or with them; and finally to impress the visitor or customer with the business-like appearance of the office itself. The chief factors to be considered may be thus enumerated:

1. The arrangement must be such as to save unnecessary travel on the part of the clerks.
2. The work must always flow in straight lines, always forward and never crossing its own path.
3. The provision of good working conditions, proper equipment, light, heat and ventilation.
4. Space must be economically used. . . .

In this investigation we compare the space at your disposal with the Best Known Practice in the economical use of office space, a standard which allots 50 square feet to each clerks, and 100 square feet to each executive in the establishment.

Our findings, then, are comprised in the following tabulation:

THIRD FLOOR

		Square feet
Total space available (less (Department M)....		4,391
Required for clerical space		
Department C.		
1 Executive	100	
27 Clerks	1,350	
Photostat equipment	150	
Special information files	275	
Miscellaneous files	50	
Mail Department		
5 Clerks	250	
Files	792	
Department C.		
2 Clerks	100	
Vault space	170	
Total space required		3,237
Excess space		1,154

(In this manner we detailed each floor, but I am omitting details from this paper and giving end figures only.)

RECAPITULATION

	Available	*Excess*
Mezzanine Floor	1,660	525
Third Floor	4,391	1,154
Fourth Floor	5,921	1,901
Fifth Floor	2,106	1,056
Totals	14,078	4,636

On the basis of your valuation of space at $3 per square foot, this excess space represents a rental value of $13,908 per annum, a sum which you are now losing, but which could be saved by a re-arrangement of the clerical space in your office. This space can be saved by a re-arrangement of your equipment alone, no change in the equipment itself being necessary, although we will have a few words to say about your equipment under that heading. Neither would it involve the removal of any partitions, walls, or private offices.

The Total deduction on Economical Use of Space is 9.5 points.

Suggestion No. 1[1]. We suggest that your offices on all floors, with the exception of those excluded as before mentioned, are greatly in need of re-arrangement.

We will endeavor to explain briefly what is covered by scientific office arrangement. It is a highly technical procedure and bears a very close relation to the work of an architect. Whenever possible it should be done in co-operation with the architect, as the building is being designed, but of course in your case, the building is already erected. The same principles apply, however, in either case. They are as follows:

First, a careful study should be made of the work of each department, the relations of one with another, and the relations of one clerk within that department with another. While this data is being compiled, the next step is taken.

Second, a scale drawing is made of present space, with all equipment shown (we usually use ¼ inch to the foot, scale). On this drawing the route of the travel of work on main routines is sketched. Any departures from the "straight line" principle of routine will then show up.

Third, when the data have been compiled they should then be studied in connection with the scale drawing. At the same time, templets should be made of the desks and other equipment shown on the drawing.

Fourth, the new arrangement should be made with the templets on a blank floor space plan, and each department lay-out discussed with all persons concerned.

Fifth, when the final details have been approved, the new arrangement should be sketched in, exactly to scale, and should serve as a guide to re-arrangement.

Here are a few things to remember: 1. Desks should be placed in rows of not more than two desks side by side. 2. Desks should be so arranged that the work flows from one clerk to another in "straight" lines on the main routine. 3. Aisles should be at least 36 inches wide. 4. Desks should not be *less* than 30 inches apart, from the back of one desk to the front of another. This allows ample seating space. 5. There should be adequate cross aisles not farther apart than 20 to 25 feet.

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[1] In this case sixty suggestions were made for the improvement of existing conditions.

Though we have said, that the space mentioned as being possible to recover in your present arrangement could be saved without eliminating partitions, we would strongly urge the consideration of the problem of removing as many of them as possible and desirable, for they waste space.

(After summarizing our findings on the other ten points, in a similar manner we give the rating on this subject of Arrangement of Office as follows):

RECAPITULATION

Economical use of space	deducted	9.5	points
Direct flow of work	"	6.8	"
Adequate light	"	9.38	"
Adequate circulation aisles	"	1.5	"
Reduction of preventable noise	"	2.0	"
Adequate ventilation	"	3.0	"
Adequate drinking fountains	"	1.4	"
Adequate cloak rooms	"	1.5	"
Adequate toilet facilities	"	0.0	"
Adequate reception room for public	"	1.5	"
Appearance	"	1.0	"
Total deducted		37.58	

Your rating on Arrangement of Office is therefore 100 points less 37.58 points, or 62.42 percent.

V. FILING: VALUE OF FILED MATERIAL

A. FIELD EXAMINER'S QUESTIONS AND REPLIES

Go to filing department, select one drawer at random and record: a. Total number of pieces filed in drawer, *2,652*. b. Number of pieces misfiled, *44*. c. Number of pieces of temporary value which should not be in file, *798*.

Note on c. There are often to be found, a number of kinds of filing matter of obviously temporary value. As you go through the files, tally each temporary piece opposite its listing, adding any additional temporary classes that come to your attention:

Catalogue requests	200
Obviously temporary price quotations	
Remittance acknowledgments	
Order acknowledgments	200
Advertising matter	
Temporary reports on statements	
Hotel reservations	
Letters of temporary value	398
Total	798

B. OFFICE RATING SHEET

The allowance for Value of Filed Material is 15 points. The formula is "deduct $\frac{15\ c}{a}$ points," in which a is the number of pieces counted and c the number of pieces obviously of temporary value.

$$\frac{15 \times 798}{2552} = 4.5 \text{ points deduction.}$$

C. SUMMARY OF FINDINGS REPORTED TO CLIENT

The crowding of files with material of only temporary value should be carefully guarded against, as it is almost a sheer waste of time and labor. In your collection department we found the letters filed in two drawers with a 25 alphabetical division. With the present number of letters, this division would not be adequate if the material were frequently referred to. But, as by far the largest portion of this correspondence is of but temporary value, a different system should be used. Out of the 484 letters examined in this department, no less than 398 were of obviously temporary value, consisting mostly of impersonal collection notes that should have been destroyed as soon as the account in question was settled. The remaining material consisted almost entirely of reference letters about customers. We examined also the files of your advertising and sales departments. Out of the 500 pieces examined, 100 pieces could properly be considered as of temporary value only. These consisted of requests for booklets, samples, prices, etc. If thought desirable, the pertinent details of such letters could have been taken off and used for sales purposes, but the letters themselves are obviously of no value for reference purposes and should be destroyed. We also found here about 100 order acknowledgments which are obviously of little future value. We have deducted 4.5 points.

Suggestion No. 19. We suggest the use of a "pending" or "suspense" file for material of this character. At stated times, say every 30 days, this file should be gone over and the material in it returned to the person who requested that it be filed. This person can then examine it and if he concludes it is of no value, he can destroy it; if he judges that it is desirable to preserve it longer, he can return it to the suspense file.

XI. CONTROL OF OUTPUT: UNINTERRUPTED FLOW OF WORK

A. FIELD EXAMINER'S QUESTIONS AND REPLIES

Are peaks in a department handled by a "flying squadron" or similar methods? *No.* Are vacations so scheduled as to eliminate peaks? *Yes.*

Are any methods for planning the work of the office in use? (Do not confuse with scheduling.) Check your findings below:

a. Approved planning method........................
b. Planning methods on part of routine............
c. Inferior planning method........................
d. No planning method........... X ....

Interview each department head and determine if work is up to date in his department. If it is not, find out how many days the department is behind in its work and what the cause for the delay is. Record the result of your interview below:

Dept. A. Up to date.
Dept. B. One to three days behind, no reason given.
Dept. C. One month behind, on account of vacations.
Dept. D. Up to date.
Dept. E. Up to date.
Dept. F. One week, vacations, statement work.
Dept. G. Two days, no reason given.
Dept. H. One week, undermanned.
Dept. I. One week, waiting on Dept. H.

B. OFFICE RATING SHEET

1. Uninterrupted flow of work.
   a. Number of departments considered......... 9
   b. Number behind in their work.............. 6

Take each department under b, and deduct as follows:

Work up to date......................	No deduction
1 day behind	deduct $\frac{2}{a}$ points
2 days behind	deduct $\frac{4}{a}$ points
4 days behind	deduct $\frac{8}{a}$ points
8 days behind	deduct $\frac{16}{a}$ points
16 or more days behind...............	deduct $\frac{32}{a}$ points

The allowance for this subdivision is 40 points; a in this case is 9. The example works out as follows:

$$\frac{2+32+16+4+16+16}{9} \text{ or } \frac{86}{9} = 9.55 \text{ points}$$

C. SUMMARY OF FINDINGS REPORTED TO CLIENT

When the office manager knows what work is to be done, and has his working force so arranged and adjusted that it can be done in a certain time under all ordinary working conditions and circumstances; and when he has his working force so well balanced and mobile that he can successfully cope with any emergency that may arise, such as seasonal or other fluctuations in the volume of work; then and then only can he be considered to have control of the clerical output.

This is a new idea, in the sense that it is more accurately and closely defined than before, and it is one of the chief features of scientific office management. The sort of control that is usually found in offices lacks this sharp definition, and is based usually on some method of driving or forcing work through, which always requires a greater expenditure of energy than is necessary. Once scientifically devised and applied, control should function more or less automatically and smoothly. A poorly designed machine may run, but generally with much clatter and waste of power, while a scientifically designed one performs its work smoothly, less noisily and with more economy of power, though it apparently is under no such strain or effort as the poorly designed one. In short, the scientific method always appears the easiest method—and it actually is.

The possession of this control is conditioned on exact knowledge of three fundamental facts: The office manager must have an exact knowledge of the capacity of the office force. This in turn means that he must also possess an exact knowledge of the standard time each operation should require and he must know exactly how much there is to do. It sounds very difficult, but aside from the basic analytical work necessary to establish it, it is not so. With these basic facts in his possession he can lay a solid foundation for the control of output. They are, in short, fundamental to successful and scientific management. . . .

Our examination of the nine principal departments in your office, shows that six of them are behind in their work. These we enumerate, with the reason for the arrears, when such reason was given:

Dept.	Days Behind	Reasons Given
B.	1	No reason given.
C.	30	Statistical work behind on account of vacations.
F.	7	Statement work behind on account of vacations.
G.	2	No reason given.
H.	7	Department undermanned.
I.	7	Waiting on Dept. H.

In Departments A, D, and E, the work was reported up to date. We have been informed also that the present is a peculiarly busy season in view of the convention to be held by your company, in consequence of which your salesmen are particularly active in sending in business in order to qualify for this occasion. The existing condition, however, calls for a deduction of 9.55 points.

It should be remembered in connection with the above, that work which happens to be held up in one department necessarily checks the flow of the same work in other departments through which it must pass. Your Dept. I attributing its delay to that in Dept. H, is an illustration of this fact. As all the departments in an office are related to and dependent upon each other, the principle of co-ordination of effort, so that the office operates as one united whole, is seen to be of fundamental importance. The fact that a reason may be given for these delays, in no way mitigates the effect, and serves only to point the way to a correction of the condition. . . .

These three examples will, I trust, explain the working of the method and show that it is an actual scientific measurement of office management against definite standards.

VI. GENERAL CONCLUSIONS

The subject should be approached with a proper appreciation of its importance and its difficulties. It is not simple—as we very quickly discovered when attempting to work it out. Many months of study and calculation were required to develop fully the formulæ and technic, and especially was it difficult to develop the latter so as to get the cost of production down to a reasonable sum. A similar examination made by one approaching the problem anew could not be completed in three times the length of time we now require to handle it. The time required is a most important element; it cannot be allowed to drag.

Mistakes made by the examiner are very quickly detected by the clients; therefore in order not to prejudice or invalidate the entire examination, the utmost care is required to avoid even the slightest error. The summary must contain facts only, and each fact, the examiner may be certain, will be checked up by the client.

To be successful, such an examination requires the possession of a wealth of data covering all possible contingencies. Though we have been collecting such data for years in our regular work, we found in a number of instances that our files were incomplete, and consequently we have been compelled to make many special investigations. I am firmly convinced that the experience gained so far in this respect has greatly improved the scientific character and reliability of our general work.

The method described, I am fully convinced, is correct and will stand with little or no change, though of course there will be considerable change in the technic and in the weighting of the subdivisions, as our experience grows.

Another remarkable and encouraging fact is the wide applicability of the method as it stands. Although we have made examinations in such widely separated lines of industries, as candy manufacturers, cotton converters, mill agents, manufacturers' agents, paper dealers, photo engravers, office appliance manufacturers, music publishers, insurance companies, wholesale ribbons, and engineers, the method applied with equal correctness in each, and with no changes whatever. Its vindication by actual test in practice in such a widely different series of industrial fields is the best practical proof of its universal applicability.

Neither has the size of the office made any considerable difference. Of course it will be admitted that it would be more successful in a large office, but we have made successful examinations in offices with as few as ten clerks.

The following comparative study (Fig. 2) of all clients who have been rated may be of interest. The table shows, *for each major section*, the average rating of all clients, the highest rating of any client and the lowest rating of any client; also the average *general* rating for all clients, the highest *general* rating for any client, and the lowest *general* rating for any client. It is to be observed that the highest efficiency in office organization is in the use of mechanical equipment; the lowest efficiency in clerical output and personnel.

SECTION	AVERAGE	HIGHEST	LOWEST
Clerical Output	51.41	98.00	31.85
Personnel	51.82	91.00	30.00
Stockkeeping	60.91	93.00	34.00
Turnover	60.99	80.00	30.00
Arrangement of Office	68.28	94.95	47.90
Intercommunication	71.55	100.00	61.00
Organization	74.04	98.00	57.00
Control of Output	75.53	82.80	67.75
Routines and Methods	75.84	80.00	70.20
Filing	77.24	89.00	62.00
Salary Standards	78.82	100.00	57.00
Correspondence	79.09	100.00	61.00
Forms	82.13	100.00	68.00
Equipment (Desks, etc.)	87.17	99.00	74.20
Use of Office Machinery	93.75	98.40	80.62

Average of general ratings of all clients	73.23
Highest general rating given any client	86.43
Lowest general rating given any client	60.54

Fig. 2. Comparison of Clients Rated.

In this connection it may be interesting to note that the plan has recently obtained the approval of one national association of manufacturers in a particular industry, and its members will be able to compare their efficiency one with another through its use. Because these manufacturers are all in one line of industry, it will be possible to add to our regular elements, a number of others peculiar to that industry, and thus make the weighting more accurate than can be done when a method must be applicable to all industries.

Any carefully thought out plan of this sort might seem theoretically sound and promising, but the actual test of such a plan is its successful use in practice. This plan has already passed what the scientific thinkers call the "pragmatic test" and we can give an affirmative answer to the question, "Will it work?" It has worked; it is working now. We have waited with modest patience for the reactions of practical "hard-headed" business men who have tested it in their office organizations, and we have yet to hear any unfavorable comment, much less any challenge of the basic principle.

In the years that lie ahead, with the steady development that experience brings to every new method, we are convinced that this principle of the measurement of management will firmly establish itself as an integral part of the scientific conduct of industry.

PROFIT SHARING

(*Continued from page* 164)

exception and not the rule.) Now, if the reward which capital is receiving is so small that if all of it went to the working people there would only be an increase of 60 cents to the head of each family, we certainly cannot look in this direction for much greater prosperity to the working man.

I have felt sure, both from my personal practical observation, and from everything that I can read on the subject, that the only true hope for an increase in prosperity to the working people lies in an increase in the productivity of every working man, throughout the country. Whether this increase comes through greater personal efficiency, through a better order of co-operation, through the introduction of labor saving-machinery, or from whatever source, it is to the increase of productivity of the whole mass of our people that the working people must look for an increase in their prosperity.

This I conceive to be at the root of the whole labor problem, and it seems to me that it is of the very first importance that the laboring people of the country should be brought to understand this fundamental fact. They are now—through labor leaders, through the press, through public opinion—taught to believe that there is something radically wrong with the division of the surplus earnings, and that if they only got their fair share of the joint product of capital and labor, everything in the world would be *couleur de rose* for them.

Now, as to profit sharing. If profit sharing would result in so stimulating the workmen who come under it that each one would very materially increase his daily output, say double his productivity, then I should look to profit sharing as the cure for the present troubles. My judgment and observation and study of men leads me to the conclusion, however, that profit sharing, while it would induce workmen to become silghtly more productive, would not have the effect of greatly increasing the average output of the individual. This has been the history of practically all profit sharing institutions up to date. It has *not* greatly stimulated the output of the individual.

And the fundamental reason for this lies in the fact that the human animal is so constituted that he looks upon his own immediate individual welfare and happiness and ease and comfort as of vastly more importance than the welfare of his fellow beings. The only way to get a large output from the individual is to let him have, in plain sight and in the immediate future, a personal reward to *him* which shall be proportional in a way to the exertions and endeavor which he puts forth; so that the profit which the men receive under profit sharing, and which comes to them only at the end of the year, or say every six months, is not a sufficient stimulus to affect them materially in their every day work. This reward is too remote.

I have seen this fact illustrated in so many different ways that to me it has come to be an absolute certainty. The average workman, for example, cannot look for-

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UNSYSTEMATIZED, SYSTEMATIZED, AND SCIENTIFIC MANAGEMENT[1]

By Henry P. Kendall[2]

THE plan of this paper is similar to one written previous to the hearings before the Interstate Commerce Commission protesting against the general increase in freight rates. The purpose of that paper was to make clear what was meant by Scientific Management, a term then unfamiliar. To present the same line of thought again receives its justification by the first words in the announcement of this conference, which states: "Notwithstanding the fact that much has been written concerning Scientific Management in newspapers and magazines, there is no definite conception in the minds of manufacturers and business men of its nature."

That this type is not well known even now is scarcely to be wondered at. Until recently little had been written for the public press and but few manufacturers were working under it, and the small group of men who were associates of Mr. Taylor, or kindred spirits, were too engrossed in their own tasks to do much talking or writing. It is my object, then, to illumine Scientific Management by describing it in terms of business with which we are all familiar, and by comparing some of its essential features with those of more familiar types of management.

Any manufacturing or mercantile business made up of different processes more or less interdependent must, to secure the best results, be so organized that the separate processes and the unit members within these will be brought into systematic connection and operation as efficient parts of the whole. To bring about and maintain this is the function of the management. To do it to the highest known degree is possible only by what we choose to call the science of management.

All types of management seem to fall readily under three heads which, for want of a more explicit terminology, we will call:

I. Unsystematized Management.
II. Systematized Management.
III. Scientific Management.

Of course no classification of this kind is exact. Some departments of an unsystematized plant may equal those in a systematized, and likewise those in the second class may approach the third in efficiency in places; but on the whole this seems a natural division. The functions of the three types of management which will be compared are:

A. Accounting.
B. Purchasing.
C. Storage of Materials.
D. Execution of the Work.
E. Efficiency of the Workers.

I. UNSYSTEMATIZED MANAGEMENT

This classification is not made on a basis of the earnings of this group, nor does it mean that they are not meeting their own competition successfully or making money. Such a condition depends on the margin which exists between their costs and selling prices. It does classify them on a basis of efficiency, and means that their costs are not so low as they would be were their form of management the systematized or scientific type. In the opinion of the writer fully 70 per cent in number of the plants in this country would belong in this class, and they are easily recognized. I do not mean that 70 per cent of the workmen in the country are working under unsystematized management, but I think that 70 per cent of the concerns in number would come under this class.

We will look at the first function, namely:

A. *Accounting.* The accounting in a business includes not only the ordinary bookkeeping, but the entire clerical system which has to do with orders, records and costs. Accounting is the only means by which the management is informed from time to time of the condition of the business, the progress it is making, its weak and strong points, its selling values and costs, and the efficiency of all its departments. How thorough, lucid and complete the information is as shown by the books indicates to some extent the efficiency of the management and its grasp on the affairs of the company. In the *unsystematized* plant the accounting generally consists of a statement prepared after the annual or semiannual stock-taking, which shows (1) Profit and Loss; (2) Assets and Liabilities. It may possibly show profit and loss by departments or by products, but this last depends on a correct method of ascertaining costs which the *unsystematized* plant seldom has. Such statements are merely a record of an historical fact in most cases. If the statement is bad it is too late to remedy the troubles of the previous year because it shows merely the result of that year. Frequently, due to imperfect methods of stock-taking, appraising and compiling, the yearly statement may be delayed; then the history it tells is ancient.

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[1] Reprinted by permission from "Addresses and Discussions at the Conference on Scientific Management, October 12, 13, 14, 1911," published by the Amos Tuck School, Hanover, N. H. The volume containing this article is as up-to-date today as when it was published and no management library is complete without it.

[2] Manufacturer (The Plimpton Press, The Lewis Manufacturing Company, etc.), Boston, Mass.

One example from my own observation—by no means unusual—will illustrate: A large concern ended its fiscal year on January 31 and did not know the result of its year's business until July 17 following, and then in the simple form of profit and loss, assets and liabilities. This information came nearly six months after the close of the business year and was then six to eighteen months old, too late to do anything to stop the leaks of that year. This was a dangerous case, but a common one.

Any firm of accountants can testify that it is no unusual thing to audit the books of a concern which thinks it is prosperous, and to show that concern that it is insolvent. Within twelve months the writer has had experience with a business in which an audit was made of the books because the proprietor thought his bookkeeper had been dishonest. The audit showed that the bookkeeper had been honest but that the concern was insolvent and shortly after it paid its creditors thirty cents on the dollar.

A lack of proper cost accounting in the *unsystematized* plant is the cause of losses and of many failures. A notorious example of this appears in the printing industry. In Chicago one large department store makes the boast that it secures its printing below cost. Its method is to send for estimates on printed forms to a large number of printers for every job of printing it has to give out, and then to give it to the lowest bidder on the assumption that some one will have figured below cost. It is reported that at the close of one fiscal year there were no less than fifteen failures of printers in the city of Boston, and it would not be strange if this proportion held throughout the country in this particular industry.

So much importance is placed upon cost of printing at the present time, that one national organization of employing printers has no less than eight men employed installing uniform cost systems in printing offices of its members throughout the country. Too little importance is placed upon accounting in the *unsystematized* plant, and as increasing competition in various industries is continually lowering the margin of profit, the accounting must become relatively more and more important to this class of business.

B. *Purchasing*. The purchasing of materials, stock and miscellaneous supplies under this type of management may be done by one man or by a purchasing department; but more likely this duty is not very well defined and the purchasing is done by a number of persons, especially those needing the material. Little study is put on the standardization of materials, and different kinds of stock for the same use are often bought. This tends to remnants on some kinds, overstock and understock on others. The buying is seldom done on exact specifications, is not always even by written order, nor is there a predetermined maximum and minimum established of each article that should be carried in stock. The head of the business or the buyer may be an exceedingly shrewd trader and may buy very close at times; but he will not always buy the materials best suited to the work, often overbuys or underbuys for lack of definite information, and is frequently tempted by bargain lots that seem cheap but may cost more to use in the shop.

The lack of well-organized purchasing results in work progressing to a certain extent through the shop until it is stopped and occupies space waiting for some material which has been overlooked, or which is not suited for the purpose. A fairly successful publishing house in one of our large cities does its buying by the *unsystematized* fashion. Last year in making up its statement of profit and loss, the inventory of paper amounted to $20,000. Three-fourths of this paper exists as overruns, or odds and ends of lots which are stored in various printing offices and cannot be used on an average-sized job. They are so scattered they cannot be combined and the make, color, finish and size are different in nearly all the lots. When this house realizes what this stock is, it will be forced to write off nearly $15,000 from its books on what it now considers good assets. Had the buyer in that publishing house standardized his paper so that whatever remained from one lot could readily be used on the next, had concentrated paper of certain kinds in one printing office, and had accurate records of his available supply, this amount of money represented in stock could be appreciably less and would equal the original cost of the paper. This sort of buying is common among *unsystematized* concerns.

C. *Storage of Materials.* Many manufacturers are willing to devote unlimited space for workrooms, not realizing that the room for the proper storage of materials is just as important and just as profitable as that used for manufacture. In the *unsystematized* plant there may be a general storeroom, but seldom are all the stores to be found in it, and generally they are piled around almost anywhere and in any way that happened to be convenient when received. The order in which such stores are kept usually depends upon the initiative of the men directly in charge, and seldom can one person assume or carry out this responsibility.

The storage of materials and purchasing are very closely related to each other. Loss of time hunting for material is the same whether the material is lost in the storeroom or has not been purchased, and a lack of system in one department will undo attempts at system in the others. The effect of badly organized stores is: (1) Loss of time; work which should go through the manufacturing departments rapidly is held up at different places waiting for materials of the proper kind or amount, and this is a direct loss. (2) Loss of space; more space is required to hold stores in a *unsystematized* way, and for lack of standardization more stores will be kept on hand than are required. Space is also lost in the workroom because work in process does not pass promptly through the workrooms if delayed for material. (3) Loss of capital, because more money is tied up in stores which are not systematized and properly regulated, and more money is tied up in the jobs which represent labor and material sidetracked throughout the plant. A lack of proper records of stores is almost always to be found in the *unsystematized* plant, and the management seldom sees the need for the so-called extra work necessary to conduct that department properly.

D. *Execution of Work.* Orders in the *unsystematized* shop are recorded in a simple manner, sometimes even received and transmitted verbally by the salesman. These are described in part verbally to the superintendent, who may further enlighten the foreman on any of the details of such orders. It is assumed that the superintendent knows his business, that the foremen know theirs, and a workman is expected to sense what is wanted and to ask questions when he is not sure. In this way an attempt is made to fill in the exact and accurate information which the selling end has either not secured or has not transmitted in writing.

The "single foremanship" plan prevails where one foreman handles as many men as he can. The number of men and the amount of work he can look out for is limited by the amount of detail which he can carry in his head and by his physical and nervous endurance. He gives work to each workman when the latter has finished his last job, and depends largely on the worker's knowledge of what to do and how to do it. As questions arise in the progress of the work, or where the written order is incomplete, the workman goes to the foreman who in turn goes to the office for instructions. Meanwhile progress on the work stops.

The workman goes for and selects his tools and appliances, and does his work in the way in which he is accustomed to do that particular kind of work. A difference in method of doing the same kind of work by different workmen and in different shops is often quite marked. A detailed schedule of the average workman's day in the *unsystematized* shop, where such day's work is varied, will show a surprisingly small proportion of effective time.

Piece-work is often used, but is bound to be unequal. The rates, determined by no exact method, are often subject to change, and the output of such piece-work is frequently limited by the unions. This lack of planning the work at the start, of complete instructions, of coordinating the departments and routing work throughout each operation, results in a congestion of unfinished work at many points. This slows down the output, occupies space and ties up capital. The frequency of mistakes in rush times and of shortages that must afterwards be made up, are not always called to the attention of the management. It is exceedingly difficult, also, in this type of plant to secure a high quality of work and to maintain it uniformly. Then, too, the costs fluctuate a good deal.

E. *Efficiency of Workers.* The efficiency, as a whole, is low and especially so in dull times. It is uneven and varies according to the executive ability of different foremen. The output of a man or machine is largely determined by the opinion of the foreman and not by any exact standard. Piece-work is not always fair, and may be too high or too low. There is no special incentive for a foreman to cooperate with the workman. Therefore, while the majority of the men may be doing what they consider a fair day's work, and some few may be working efficiently, the efficiency of the whole is low.

One example will illustrate a well-known loss in efficiency. A workman in the hat trade performed one process in making a hat by piece-work, and earned not over $15 a week. He was well adapted to that kind of work and could easily have earned $25 a week at that rate and would have been happier doing his best, especially as he needed the money. He was limited to $15 a week by the union. It cost that firm more by this method, because the floor space occupied by this part of the work could have turned out 60 per cent more hats if the men had been rightly selected for that kind of work and had been permitted to do their best. It also cost more because overhead charges were 60 per cent more per hat than was necessary for that operation. More than that, a workman who is well fitted for a task is not happy when he is not doing his best and earning all of which he is capable. There is an economic loss to each, and the result is bad. Even greater inefficiency than this may occur with day workers.

II. SYSTEMATIZED MANAGEMENT

This term as used here applies to the well organized and managed plants which make no claim to Scientific Management as such. In these plants the managers are methodical and systematic, have studied and systematized each department carefully and aimed to secure the best that has been done in the line of systematizing up to the present time. As stated before, in some departments of many such plants, the efficiency is exceedingly good.

A. *Accounting*. In this form of management the accounting is well done. The books will show the condition of the business quarterly or monthly, and in considerable detail. This will include the comparative feature; that is, for example, last year's costs to date with this year's costs for the same period, for a given department or product; will show costs of materials and labor, and the proportion of overhead charges that make up the cost of a single job or a given product. Such results may even be charted and shown in graphic form to the management each month. Other records will come up weekly or even daily. As accounting is the means by which is ascertained the exact condition of the business at a given time, the *systematized* management recognizes the importance of this information. Much of this accounting, however, is done with the ultimate end of securing correct costs, and these cost data are relied upon almost wholly, (1) to establish the selling price, and (2) to point out excessive costs and indicate perhaps where they may be reduced. Many believe that when their accounting is well done they have a systematized and efficient plant, but this really covers one phase only of the management.

Frequently, too, the clerical work in the different departments is not a part of the general accounting, and is not controlled by the ledger accounts. In other words, the same general system of accounting does not permeate the whole plant and help to support itself.

B. *Purchasing*. Materials and supplies are purchased through one man or department, a maximum and minimum generally established, and a decided effort made to purchase the materials best suited to the workrooms. Some analytic methods are used in determining the proper materials, and standardizing is done on the more important kinds. This purchasing department aims to have a stock of everything required, but buys largely what it is asked to. It does not always make purchases on complete specifications, and a lack of complete standardization increases the detail of that department. So far as the clerical system is developed, however, it is generally quite good.

You will recall the words of a well-known railroad president some time ago who stated, before the Interstate Commerce hearings, that the railroads had reached their ultimate end of efficiency. It is interesting in the light of this statement to note an example of efficiency in purchasing by one system of railroads, which has been acknowledged to me by railroad officials as leading in this particular department. This is the purchasing as done by Mr. Thorne, who buys over $40,000,000 worth of materials annually for the Union Pacific and Southern Pacific railroad systems. One characteristic of Mr. Harriman when he took over a railroad was that he would go to any expense in order to standardize every bit of material used. Mr. Thorne is the man who carried this out. In a letter the other day he told me that in the standardization of printed forms alone he had saved over 30 per cent in the purchase of that particular commodity. In standardizing these forms he reduced them in number, specifying certain standard sizes of paper, type, and other conditions to be followed, and I have no doubt that in his other purchases his methods have secured a great saving over those of competing roads.

C. *Storage of Materials*. A marked contrast to the storage methods of the *unsystematized* plant will be seen at once. Here is an adequate room in charge of a storekeeper who issues stores only on requisitions, and is expected to keep his place neat and orderly and deliver his stores on call. A perpetual list is kept in the office and balances with the stores, and the balance is proved by an actual count of the stores once a year or oftener. Stores are partially classified and standardized to some extent. It is only the most-used stores that are assigned to orders before actually called for. The physical handling of the stores, moving them in and out of the storeroom, is done by the assistants of the storekeeper and the efficiency of this work and the orderliness of the department depend wholly upon the kind of man in charge. The central office can exercise very little real control in this department.

Not all systematized plants control work from a central planning station by writing the operations for each process before the work is started; therefore materials are not exactly predetermined and work is still likely to be started before it is discovered that some material is lacking. Neither are the quantities always kept up automatically through the purchasing department by a predetermined maximum and minimum of each kind. Also, it is general practice to have storage space for different departments, some of which are not under control of the office; for instance the miscellaneous supplies used by the power department for repairs, piping and plumbing, electrical maintenance, etc., may be scattered about with little idea of order, while the actual materials for manufacture may be in good order.

D. *Execution of Work.* A complete set of order-cards for recording and transmitting orders is in use. The worker receives a written order for the work he is to do. This seldom takes the form of an instruction card giving him complete information for every move and every tool. It is apt to say *what* the work is, assuming that he will do it in a satisfactory manner. Workers almost always record their time for each job on a card which registers the labor cost accurately. They do not always register the time lost in securing tools, materials and further instructions. The planning of a job, except in plants where the work is very largely repetition, is likely to be done as the work proceeds. Piece-work is used wherever possible, and is considered the most economical way of performing a given operation. It is the aim of most *systematized* plants to secure as much piece-work as possible. This may be unfair for different kinds of work to both employees and employer.

Under *systematized* management the system keeps things running smoothly, avoids most of the mistakes due to the lax methods of the first kind of management and turns out a good product. But a lack of centralized planning and centralized control of workers causes loss of efficiency.

E. *Efficiency of the Worker.* The emphasis of *systematized* management is laid on costs, freedom from errors and bad work, and the greatest output per man and per machine that can be secured. The standard for this output is generally established by the opinions or experience of the bosses, who have neither the time nor the training to ascertain it by exact methods. Great emphasis is put upon the installation of new and modern machinery, but there is not very much analytical work done by the management to ascertain whether the worker is working in the very best possible way, or whether he is adapted to the particular job he is given. The person who has charge of the employment considers that there are four classes of people—men, women, boys and girls. If the foreman wants a girl, that is sufficient information for the one in charge of the employment, and a girl is hired and assigned. Little or no thought is given to the question whether that particular girl is the right one for the task.

For instance, in bookbinding there are different kinds of work. Laying gold leaf calls for a girl with small fingers and a delicate touch. Strength is not required. Another operation calls for a large, strong girl, who can easily handle bundles of work weighing seven or eight pounds. In proofreading the time reaction of seeing a word and grasping its meaning is a very important feature. Other girls doing inspection must have the ability to concentrate their minds on one particular operation. The different kinds of work demand girls selected with special reference to their aptitude for their particular work. In every factory will be found workers in one department who cannot successfully do their work, but who could successfully do work of another kind. The scientific selection of the worker is almost unknown in the *systematized* plant, and this fact alone makes impossible the highest efficiency.

When I think over the psychology of industrial workers, I am reminded of my own experience in college. In the psychological laboratory tests were made on all my class. I had the quickest time reaction from seeing a flash of light to muscular action in pressing a button; I had the slowest time reaction in the class to seeing a word, comprehending its meaning and then pressing a button which registered the time it had taken me to see and comprehend its meaning. This experiment showed the reason why I was the slowest reader in my class and why on a given task in reading, in literature or any other subject, I took longer than any one else. While not a sprinter, my record for the fifteen-yard dash has never been beaten—not because I was a fast runner, but simply because the time reaction to muscular effort enabled me to get off more quickly after the pistol shot than any one else. I never could have made a proofreader, or earned my salt as bookkeeper, but I think I should have made a tolerably good motorman.

The step from *unsystematized* management to *systematized* is a difficult one because it generally means a more radical change in the personnel of the supervisory force than does the other step. The *unsystematic* manager is likely to associate with him men of a similar type. To do one's work in a systematic way is not wholly a matter of training, and the foremen and superintendents in a thoroughly *unsystematized* plant cannot always develop the habit of working by means of system. The *unsystematized* plant still remains, either because its competitors are in the same condition or because there is a large difference between costs and selling price, or because the business is dominated by one or more strong characters whose ability in other phases of their work more than makes up for their lack in organizing ability. Sooner or later, however, this class of industries will be forced to change or be eliminated. This has already taken place in a number of industries, as for example, the manufacture of shoes.

Twenty-five or thirty years ago there were more shoe shops than there are today. The competition in manufacturing shoes and the intricacy of the detail have made it impossible for the *unsystematized* plant to grow beyond the limit of the single foremanship plan, with the result that only the *systematized* plants could increase. The others were absorbed or ceased to be, and today there is probably not an *unsystematized* plant engaged in the manufacture of shoes. Indeed, some few shoe manufacturing concerns are developing *Scientific Management* very rapidly in all their departments. And what has happened to the shoe industry is now happening to other industries which are in the transitional period through which the shoe manufacturing industry passed twenty or twenty-five years ago.

III. SCIENTIFIC MANAGEMENT

A. *Accounting.* The accounting under Scientific Management shows the manufacturing and expense accounts for the year by thirteen periods of four weeks each, instead of twelve monthly periods, and at the expiration of each of these periods it shows the profit and loss and assets and liabilities. These in the *unsystematized* plant are shown yearly, and not always in the *systematized* plant are they shown even monthly. Further, the group and unit costs of the various products, the cost and output of each department and all expenses which might be applied directly to the product, are shown in full, and the "comparative" features are much more useful because four-week periods give a more equal basis for comparison. A monthly statement as shown by the books in the *systematized* accounting does not give an accurate comparison because, for instance, some months will have five pay-rolls where others have four and the number of working days varies by quite a per cent because there may be five Sundays or five Saturday half-days.

In substance, the general accounts of the company are shown in more complete form every four-week period than is shown by the yearly accounting in the *systematized* class. The ledger accounts have absolute control over the stores department, over the quantity and value of stores, work and materials in process, and manufactured goods; and as every department and function of the manufacturing coordinates with every other, the accounting becomes a part of the very bone and fibre of the manufacturing.

One radical difference in point of view is that the ascertaining of costs does not have a special system installed for just that purpose, and the ascertaining of costs is not the end sought. Under *Scientific Management* costs come as a by-product of the means used for increasing efficiency. For instance, a ticket made up in the central planning department, when combined with the instruction card, serves to plan the work in advance; then it is used to control the order of work by being placed on a bulletin board; then it gives the workman his particular piece of work to do with the instructions how to do it. On this ticket is stamped the time at which the work is begun and when it ends. This same ticket then serves to check off the progress of the work on the route-sheet. Then it goes to the accounting department from which the man's pay is made up. It is then redistributed and furnishes the labor cost of the particular operation on the cost-sheet of the job. From cost-sheets similar to this are summarized not only the cost on all jobs, but also the department expenses and charges which appear in each four-week period statement.

In other words, the mechanism used under *systema-*

tized management for ascertaining costs performs little other work; under *Scientific Management* it has performed its part in producing work, and from it, as a by-product, so to speak, come the costs.

The ascertaining of costs by this method is done with but little more expense than is necessary for handling the regular work of operation. Too much emphasis cannot be placed on the value of the comparative feature in accounting. Comparisons are a great spur to increased efficiency, and this fact is recognized as well in the *systematized* management. For example: a certain group of department stores each doing a business in a different city and non-competitive, have found such good results from uniform accounting methods and the information that comes from comparison, that they jointly employ an accountant who collects the monthly reports in detail from these stores so as to make a comparison by items, and then prints these data for the use of the management of each store.

For instance, one manager finds that Department A in his store did $50,000 worth of business the preceding month, had $35,000 worth of stock on hand, and is shown in detail what the labor and other expense items of that department were. He sees that another store did $55,000 worth of business in Department A and had a stock of but $20,000. He immediately summons his buyer and informs him of the result of this comparison, and asks why he cannot do as well as the buyer in the other store and release $15,000 of capital now tied up in stock. The knowledge of what can be done and is done by the other store is often sufficient stimulus in itself to cause to be accomplished what otherwise would not be considered possible.

The expense and frequently the shutdowns for the purpose of the annual stock-taking are eliminated under *Scientific Management*, because the accounting absolutely controls the movement of materials in and out of the stores department, so its records show at all times the amount in stores and this value can be ascertained when desired. The work of proving the items of stores is done continuously, and the days, which often become weeks and months, that elapse before even large and well-organized concerns get the results of their stock-taking become a thing of the past. One large concern which is a customer in a business in which I am interested finished its year of stock-taking January 1, and it was early in August of this year before it got the results and knew how much stock it had on hand January 1. The same will apply to the amount of materials and labor in process, which the *systematized* management finds even a harder problem to handle, and also to the value of manufactured goods.

B. *Purchasing. Scientific Management* is not satisfied merely to have plenty of materials on hand when wanted, to roughly standardize the principal items of stock used and to buy at the market rate, but demands that all materials be carefully studied with reference to—

First. The greatest adaptability to the work.

Second. Quality and uniformity.

Third. Price.

Fourth. Determination of the proper maximum and minimum that shall be carried, so that the stores department may automatically govern materials and supplies which should always be on hand.

When this has been done, care is taken to make all purchases on detailed specifications. The importance of using materials best suited to the work and which are uniform in quality and by standardization reduced to the smallest variety, is not sufficiently appreciated by the buyer in even the *systematized* plant.

For example, a manufacturer of razors using a thin blade could not secure a steel which would always act alike and produce a uniform result with uniform treatment. He employed a steel expert of reputation to assist him. This expert purchased the best razors that different barbers had, analyzed them chemically and microscopically, and, as every man who uses a razor might guess, found very great variation even in the same makes. In fact, he satisfied himself that no razor manufacturer, however well-systematized his plant was, had ever scientifically determined the best steel, or had purchased it on a formula that would standardize this material. As a result, all these years the buying of a razor had been a lottery.

After many tests this expert secured from various steel manufacturers samples of steel on their formulae and his own, and he finally developed a formula that would give the best razor steel known and maintain it uniform. As a result of this method of buying this manufacturer stood alone among the razor producers of the country in ability to produce razor blades of standard quality. If all his methods are as scientific as this, it is doubtful whether his competitors will ever overtake the lead he has secured. This is not an extreme example by any means.

Another illustration of the standardizing of materials. In studying the supplies of a business it was found that there were twelve kinds of wrapping paper regularly used and an investment of $2,500 was needed to carry a sufficient amount. This was standardized and now the twelve kinds of paper have been reduced to four, with a saving of $1,000 in the stock, 60 per cent in the storage space occupied, and the available worth of this paper for the demands that may be made on it is 20 per cent more than what it was formerly. This illustrates the saving made on but one class of material used in a factory where standardization is being worked out.

Such methods of purchasing compel the purchasing department to be intimately associated with the working of the materials through manufacture, and result in the following:

First. Uniform material best adapted to the work saves labor and delay in workrooms.

Second. Minimum of kinds and sizes necessary to be carried.

Third. Storage space saved.

Fourth. Lower costs through buying in larger lots.

C. *Storage of Materials.* The physical aspects of a storeroom under *Scientific Management* do not differ greatly from those in the *systematized.* A proper means of holding or piling the stores, laid out in an orderly fashion, is provided. To avoid confusion in a varied terminology, mnemonic symbols are used to designate the different kinds of stores. The maximum and minimum mentioned above are determined for each kind, and kept on the ledger sheets in the central planning room. The bookkeeping for the stores is not carried on in the storeroom, the storeroom force simply acting on orders. The location of the materials is also indicated on the ledger sheets, or, as they are known, the balance of stores sheets.

The storeroom in the *systematized* plant is not likely to carry all the materials and supplies used in the entire plant. The engine-room, plumbing and construction supplies may be carried in places provided for them, but not controlled as other materials are. Stationery and office forms and supplies may be carried somewhere else under a different system. Even in well-systematized plants such items as are not considered a part of the general stores system cause more or less trouble by being used up unexpectedly.

Under *Scientific Management* it is not sufficient, when materials are required, to send a requisition to the stores department, but all orders or work which require material have the items looked up and assigned to the specific orders by the balance of stores clerks, and this material when assigned to a given order is not available for another order which may follow. This is done before the materials are required for use, and this method serves as advance warning to the stores clerks if an unexpected demand for a particular material is likely to occur. Quick action is then possible in purchasing more.

The work of moving materials into the stores department and moving them from the stores department to the particular place where they are to be used, becomes a function of the planning of the work, and of the routing of the work, and the workman who is to use them should not be delayed or have to give a thought to the materials which he needs for his next job. They are moved in the right condition for his use to the point where he can use them to the best advantage. The *time* which the workman spends looking for or waiting for his materials can be better spent in effective work. The proper working of the stores department in many industries, and especially in mercantile establishments, is a very important one.

D. *Execution of Work.* The theory of the proper execution of work is that it should be planned completely before a single move is made—that a route-sheet which will show the names and order of all the operations which are to be performed should be made out and that instruction cards should be clearly written for each operation. Requisitions on the stores department showing the kind and quality of the materials and where they should be moved, and lists of proper tools for doing the work in the best way, should be made up for each operation, and then by time-study the very best method and apparatus for performing each operation is determined in advance, and embodied in the instruction.

By this means the order and assignment of all work, or routing as it is called, should be conducted by the central planning or routing department. This brings the control of all operations in the plant, the progress and order of work, back to the central point. Information which even in the *systematized* plant is supposed to be furnished by the knowledge of the workman or the gang-boss or foreman, is brought back to the planning room and becomes a part of the instruction card.

In many *unsystematized* plants no attempt is made to change the method by which the workman performs his operations. Plenty of time and money may be spent on special machinery, but when that is installed very little time is spent in a close analytical study of the time elements and motions involved in operating, in order to make it possible for the workman to work in the easiest and best way and to furnish a fair basis of remuneration.

When the analytical study has been made, the probable time of operation determined, and a sufficient incentive has been added in the shape of a bonus for performing the work in the given time and in the way specified, then work can be much more accurately controlled from the central planning room because it is likely to be done in approximately the time determined and without lagging.

By *functional foremanship,* which has been described by previous speakers, the management brings to bear on each phase of the work a man particularly fitted by selection, training and experience to assist in performing that part of the work. His function is to assist the worker and cooperate with him to enable him to increase his earning capacity by eliminating trouble or delays or wrong methods. Even in the well-managed *systematized* plant the manager will tell you that the weak point in his business is the inability to secure good foremen, or good superintendents. He demands:

First. That the foreman shall know all about the work which is done in his department.

Second. That he be a good disciplinarian.

Third. That he have the ability to crowd work through and get it out quickly.

Fourth. That he be cautious and accurate.

Fifth. That he be able to keep account of innumerable details.

To find all these qualities combined successfully in one man is exceedingly difficult, to train such men is also difficult, and to secure them by natural selection and "survival of the fittest" takes too long; but to train men for functional foremanship by selecting the best man fitted to do the particular function and then training him in that, is simply one kind of division of labor which has marked the progress of civilization.

The execution of work which is largely repetition, where the individual processes are simple, reaches a very high efficiency in many *systematized* plants. The difficulties in securing efficiency increase as the work becomes more varied and with less proportion of it repeat-work, and in proportion as these difficulties increase ordinary systems fail to produce results in more intricate work. This can be attained, however, by the central planning room from the analysis and time-study which is put into all operations of work and reduced to instruction cards.

E. *Efficiency of the Worker.* On many simple operations in manufacturing, piece-work has always been considered the most efficient method of securing output and low costs, and it is true that where the remuneration is a just one and when the employee is supplied with proper materials and works to the best advantage, this method of performing work approaches very close to that of *Scientific Management,* but such conditions of piece-work are the ideal rather than the usual. As stated above and emphasized by previous speakers, piece-work with prices based on the snap judgment of a foreman or by an imperfect test of a single worker, is not the correct method to secure the greatest efficiency. Besides this, there are many kinds of work which are not adapted to piece-work. Under *Scientific Management* the efficiency of the worker and machine depends on five other conditions, after assuming that the parts of the management which have to do with purchasing, storage of materials, etc., are well performed. These conditions are:

First. Analysis and synthesis of the elements of operation.

Second. Scientific selection of the worker.

Third. Training of the worker.

Fourth. Proper tools and equipment.

Fifth. Proper incentive.

First. The first condition on which the efficiency of the worker depends is that *the management shall analyze carefully and thoroughly every operation into its ultimate elements;* shall then reconstruct those elements in their proper sequence, eliminating those which are unnecessary or those which are bad, and reducing the form to a written instruction card for him to follow; the time elements having been determined and becoming a part of the instruction card. It is interesting to see what develops when one really begins to study a seemingly simple operation. The motion-study alone of bricklaying makes possible the elimination of sixteen unnecessary motions. The change in location of a machine which was operated by a girl who sat with her back to an aisle where heavy trucking was done caused an increase of 25 per cent in her work. Every time she heard a truck approaching she involuntarily shuddered, probably wondering if the truck would strike her. Removing this operator to a quite corner caused the increase.

One factory doing light manufacturing has lately put some time into studying what have always been considered simple operations. In certain places a differently shaped receptacle was made for the articles on which work was being done, bringing the pieces within six inches of the left hand, whereas for years before the worker had had to reach for these and occasionally stop work to bring the articles farthest away within reach with a sort of a hoe. Other operations in this plant have been simplified by changing the position of some workers so that the porter who supplies materials can do so without interrupting and causing a stop in the work several times a day. A study of extra steps and little delays by an intelligent observer is a necessary work before the greatest efficiency can be secured. When all these analyses have been reduced to writing, a study of the type best fitted to do this work is made.

Second. Scientific Selection of the Worker. The type of worker who physically and mentally is best fitted to do a kind of work must be selected after a careful analysis of that class of operations made with reference to physiological and mental differences in human beings. The difference in output and quality of work has been found to vary as much as 40 per cent or 50 per cent in a group of men or women engaged on the same kind of work. As they were of apparently equal intelligence and education, this could be explained only by the physiological and mental differences. As a result of time-study and motion-study of various groups of operations in one large manufacturing plant, it has been found that there are so many workers performing a kind of work to which they are not suited, but who might excel in another kind of work, that the management has laid plans to establish classes to instruct workers to do another kind of work better adapted to their capacities.

Of two different departments, A and B, for instance —A containing thirty girls and B twenty—it has been found that over 20 per cent in A are unfitted for that kind of work, but would be fitted for work in B, and *vice versa.* A scientific selection of the workers is possible only from the analysis of operations. The effectiveness of this will be greater when the principles of the psychology of working and kinds of work are better understood by industrial managers.

The psychology of advertising has lately been coming to the front. The psychology of industrial workers is still a great field for research. The vocational schools will not perform their true function properly until they come to a better knowledge psychologically of the mental and physical requirements for different kinds of work, and are able by tests to determine in which their pupils are likely to be successes or failures.

Scientific selection of the *workmen* is but a part; the scientific selection of *foremen, of superintendents and managers is just as important.* How frequently one sees a man struggling with the details of an office or with the wear and tear of executive work, on the verge of nervous prostration, when that man is wholly unfitted for that kind of work and his attempts successfully to perform it result in his undoing. If managers themselves knew how to judge a man's fitness for his work and were more observing, there would be many less breakdowns and physical wrecks than there are now.

Third. Training of the Worker. Having first carried out the study of the operation which has pointed the way to the proper selection of the worker, it becomes the duty to train the worker to do the work in the way which the result of the analysis has shown to be the best way. This will be accomplished by a functional foreman whose duty it is to train the workmen and help them on each job to get started right. If they fail to do the task in the time fixed it is the duty of the functional foreman to find out why they have failed, and to help them do the work as it should have been done. This is a wide departure from the old school, which assumes that the journeyman has sufficient knowledge to do his own work in the most efficient manner. In the training of workmen it is interesting to see how they develop through an aroused interest and cooperation of those over them.

Fourth. Proper Tools and Equipment. The fourth condition is that the worker be supplied with the best tools and just the ones needed for the particular operation, and supplied when needed; that he be given the best machine, maintained in first-class condition, so that machine, belt and tool failures will be reduced to the minimum. To maintain the machinery, etc., in this condition is a duty of the management, and *Scientific Management* provides the means with which to do this.

Fifth. Proper Incentive. Sufficient incentive should be given the worker to perform the operation or the task that has been set in the given time. To make this possible for the worker, functional foremanship is necessary and the principal object of such functional foreman is to assist the worker and eliminate trouble or delay. The functional foreman trained to his specialty will do this more effectively than the old-fashioned all-around foreman. Examples have been given by previous speakers of relative increase in efficiency of the worker as a result of *Scientific Management.* Of course such relative increases in output cannot be considered universal. Certain machines are not mechanically able to run at double or triple their former speeds, but *Scientific Management* tends to lessen the numberless little delays which the condition of the machine, of the material to be worked upon, or the instructions to the worker, may have been responsible for.

It must be to the financial interest of the worker to be industrious, and it has been shown to be for the interest of the management to do everything to make possible and profitable this increased industry of the worker, thereby gaining a more uniform output, and an output per man or machine which is maintained more uniformly in dull or busy times.

There is another feature which is of interest; that is, if the worker engaged on the task and bonus does not receive his materials promptly and on time, if his machine is not in the condition it should be, or there are other avoidable delays, the worker has sufficient interest in the probable loss of his bonus to make a serious kick, and it is the duty of the gang-boss to immediately right this trouble. Therefore, the workman and the boss are together demanding of the management that as nearly as possible perfect working conditions be maintained.

IV. CONCLUSION

The central planning and control of work which is such a vital part in *Scientific Management* is not developed to the same degree in the *systematized*. In *systematized* plants where complete planning is attempted, however, the instructions and orders particularize *what* is to be done rather than *how* it is to be done.

In the *systematized* plant the system in one department has been planned especially for that department, and is not a part of the system framework which pervades the whole, as in *Scientific Management*, and it is a constant fight to maintain such independent systems and especially to change and modify them with changed conditions or the increased growth of the business.

In closing let us see the effects of this type of management in general on the plant, the product, the worker and the management.

Plant. Scientific Management furnishes the machinery for maintaining the plant in better condition by centralizing the control, by the use of such devices as the standing order file in which are collected and reduced to writing and properly indexed the practices and rules of the company. From it, by listing and making a certain program of things to be done—the departments, machinery, shafting, drains, gutters, etc., to be inspected—this program can be handled month after month by routine in a manner which the management has carefully predetermined. To attend to the maintenance of a plant in this way is working to prevent delay and expense rather than cure it afterwards. For instance, eliminating delays due to belt failures, shaft-boxes which have been overlooked and run dry, and indefinite inspection of premises, pipe lines, traps, etc., tends to save expense by preventing trouble.

Product. The product of such a plant should be more uniformly even, and there should be fewer mistakes and less inferior work. Once a standard is set for each operation, that standard can be maintained. It costs little more to maintain a high standard under these conditions than a low one under old conditions.

The Worker. The condition of a worker's mind has a very large effect on his physical being. There is a psychological effect on a worker in having the work divided into definite tasks, each one having its goal in sight and sustaining effort to that time. The piece-workers in one plant in which I am interested were interviewed by a woman journalist at the time so much publicity was given to *Scientific Management* by the hearings before the Interstate Commerce Commission, and she asked them how they liked the task and bonus. They said they didn't know why it was, but they liked it; they were earning more. But that was not all: the piece-work flowing to them in an unending stream had been discouraging; there was something they could not understand, but when it was broken up into definite lots they liked it much better. You can discourage any man by setting him to work with a pick and shovel and telling him to shovel away a hill. He knows he can never get it done, but if you say: "Here, you shovel so many tip-carts full in a day, or in a given time, and you will have a certain percentage of increase of pay for that time," you have changed the point of view, and that man every time he finishes a tip-cart full has accomplished a definite task. His effort is sustained for that time, and he is going to be able to sustain that effort in the future. That is one reason why profit-sharing among the working classes is almost an absolute failure so far as increased efficiency is concerned; the time of sustained effort for a year or six months is too long. Neither can a worker do his best work who is nagged by a foreman, who has been given insufficient instructions and is fearful lest he is doing his work wrong, and who, having made a mistake, is jumped on, oftentimes perhaps unjustly. He is not in a frame of mind to do his best work if he wishes to.

In one factory there was great difficulty in keeping the women workers in a certain department. They were either unwilling to continue to work or frequently gave out, and it was a puzzle for sometime to find out what the trouble was. When the analysis and time-study were put into this department, it was found that part of the trouble was due to the fact that they were not earning so much as workers in adjacent departments, that they were nagged by the foreman who did not understand how to handle help, and that they were working at a disadvantage in the arrangement of their work places. The first step was to fit up their places so they could work to the best advantage. A time-study then showed that by working according to instructions they could easily do 50 per cent more work. To insure the work being well done, one of the best girls was selected as an inspector and given charge of their work, the foreman having nothing to do with them. A few of the girls were tried on the extra work—working under the constant instruction of the time-study man and being paid an additional amount.

All the girls who were physically fitted for this kind of work tried the extra amount, which they did easily. The result of the extra pay, freedom from the nagging of the foreman, and easier working conditions, immediately stopped the difficulty in keeping workers in this department. One or two of these workers, according to the report of the factory nurse, have gained weight since this change was made.

After this had been in effect for a while, the constant request of one girl that she be allowed to undertake one-third more work, or double the original amount, was granted with the approval of the factory nurse, who watched her closely. This was a task not set by time-study, but one which the girl herself thought she could undertake. She found, however, that it was too much and gave it up voluntarily, but she is still doing 50 per cent more work that she was originally. She is a girl well fitted for the kind of work and for her a larger task could be given, but tasks are set with the idea of the average worker who is first selected for the particular kind of work. It must be considered that the effect of task and bonus work under the proper conditions tends to greater industry, better discipline, a happier disposition and greater interest in work on the part of the workers. Greater regularity, greater accuracy and neatness must and do have an influence on health and character.

Management. It is probable that the point of view of heads of departments and those responsible for the management becomes quite as much changed as that of the workers. When mistakes are made the responsibility is fixed and the management cannot dodge the fact. A manager also realizes as never before the value that must be placed on analysis. As Mr. Taylor once said: "Thought under *Scientific Management* is 75 per cent analysis and 25 per cent common sense."

When a seemingly difficult operation has been analyzed to its last detail, it is not so difficult to reconstruct it on the proper lines. There is, too, an added interest to the management in the feeling that it is working on a plan, the underlying principles of which are already determined, and the details of which are to be developed in accordance with those principles more and more finely as years go by.

It has been my pleasure to have employed a number of young college men. Before they start to work, while they are in the only impressionable period that exists after they leave college—that is, when they first come under the eye of the manager—I tell them that had I known or realized the comprehensive plan of work under which I am working now, an equivalent of three years of the hardest work I have ever done could have been saved. The hard work would not have been saved, but I should have been saved three years because I should have been working on a plan rather than groping around in the dark and formulating plans many of which have had to be abandoned.

Probably many of you will say, "That sounds all right, but is not fitted for my business." I was very much interested to talk with a man who is the editor of one of the most progressive magazines, who told me today that he had been using some of the apparatus which he had seen in use under *Scientific Management*. His work is editing. Editors have always said that their work is not subject to *Scientific Management* because their work does not deal with systems,—their work deals with brains. I was much pleased to have him tell me that he has constructed a bulletin board in his office with which he is planning his editorial work, so that already he has done four months work in one month and is up here for a two weeks vacation, or somewhere for a two weeks vacation, because he has that time which he never had had before under the old working conditions. Besides this saving in his own time, he has reduced the amount of money invested in a mass of paid articles, and now buys such only as are required for a given edition.

Beneath all this there is a good deal of philosophy. It seems to me that this is the best solution of a fair compensation for labor because it puts a premium on the efficiency of both employees and employer, and the success of *Scientific Management* depends upon this close cooperation of employer and employee. Along some such line it seems to me will sooner or later be worked out the great problems of labor and capital.

COMMITTEE ON MANAGEMENT WEEK

BY agreement of the cooperating societies a joint Committee on Management Week has been organized with headquarters at Cleveland. This committee will organize and supervise all activities of Management Week.

The Committee consists of five members:

Mr. V. P. Geffine, National Association of Cost Accountants.

Mr. J. F. Price, Society of Industrial Engineers.

Mr. Keppele Hall, Taylor Society.

Mr. D. W. K. Peacock, American Management Association.

Mr. John Younger, The American Society of Mechanical Engineers.

This committee has mapped the United States into seventeen territories and has assigned regional directors to each.

The duty of these regional directors is to stimulate interest in Management Week in their territory, to foster meetings, and to see that good programs and good speakers are arranged for. It is their duty to act as a clearing house between the territory they represent and the national committee here in Cleveland. This scheme worked out very well last year and is being considerably increased in scope this year.

Territory No. 1—Buffalo, including Erie, Pa., on the west and Albany, N. Y., on the east. Mr. W. W. Kincaid, President of The Spirella Co., Inc., Niagara Falls, N. Y., and President of the American Management Association, is assigned as regional director.

Territory No. 2—State of Ohio, is assigned again this year to Colonel Keppele Hall.

Territory No. 3—New England Territory outside of Boston includes principally Western Massachusetts, Connecticut, Vermont, Maine, and New Hampshire. Mr. Henry S. Dennison, member of many societies is assigned as regional director and Mr. L. M. Lamb of the Greenfield Tap and Die Corporation is suggested as one of the committee.

Territory No. 4—Boston vicinity, and Rhode Island, is again assigned to Sanford E. Thompson, who made such a success of the Boston meetings last year. It is suggested that F. Richmond Fletcher of Scovill, Wellington & Co. of Boston will act with him on the committee.

Territory No. 5—New York City and New Jersey. Irving A. Berndt is assigned as regional director with Mr. J. M. Jordan, President of the National Association of Cost Accountants, to assist him.

Territory No. 6—Philadelphia and Harrisburg, and points south to Carolina. Mr. Elisha Lee of the Pennsylvania Railroad is being approached to act as regional director and John Scanlon of the Hess Bright Manufacturing Co. is suggested to act on his committee as representative of the National Association of Cost Accountants.

Territory No. 7—Pittsburgh District and West Virginia. K. F. Treschow, Secretary of the Western Pennsylvania Engineering Societies, is assigned as regional director. Mr. C. G. Jensen of the A. M. Byers Co. is suggested as one of his committeemen.

Territory No. 8—Illinois and Wisconsin, with Chicago as headquarters. Professor Hugo Diemer is again assigned as director for Chicago.

Territory No. 9—Indiana and Kentucky. T. Neill Wynne of the Indianapolis Light and Heat Co. has been assigned as regional director.

Territory No. 10—Alabama and the states touching it. This territory has Mr. J. W. Moore of Birmingham as its regional director.

Territory No. 11—Oklahoma, Texas, Arkansas, and Louisiana. This is practically the oil field region of the country and Tulsa is having a petrolum exposition during Management Week, at which Mr. J. E. Stillwell is arranging to have papers delivered on management subjects. Mr. H. P. Porter of Tulsa is assigned as regional director with Ralph O. Van Thurn of the Cosden Company assisting him on the committee.

Territory No. 12—Colorado, Wyoming, Utah, Idaho, and Montana. A. H. Lichty, Vice-President of the Colorado Fuel and Iron Co., of Denver, is assigned as regional director.

Territory No. 13—Minnesota, the Dakotas, Nebraska, and Iowa. Mr. Dean Flowers, President of the St. Paul Engineering Society, is assigned as regional director with Mr. F. H. Tuttle of the N. A. C. A. and the Photo Plating Co. of Minneapolis assisting him on the committee.

Territory No. 14—California and Nevada. Mr. Robert Sibley of The American Society of Mechanical Engineers is assigned as regional director with Mr. C. A. D'Arcy of the Zellerbach Paper Co. of San Francisco assisting him.

Territory No. 15—Oregon and Washington. This territory is showing a great deal of enthusiasm under the direction of Ira Dye of Seattle, who has been assigned as regional director.

Territory No. 16—Detroit, Michigan. The Society of Industrial Engineers, Detroit Chapter, has taken the initiative and is arranging a two-day program. It is suggested that the S. I. E. chairman act as regional director for the State of Michigan. Mr. J. J. Martindale is their Chairman and it is suggested that F. H. Dodge, Vice-President of the Burroughs Adding Machine Co., and Sidney C. Guthrie of the Jansen Mfg. Co. should act on his committee.

Territory No. 17—Missouri and Kansas. Mr. Brockway, President of the Kansas Engineering Society, is assigned as regional director.

Every member should plan to attend the Management Week meeting in his locality—on some evening during the week of October 22 to 27, as determined by his local committee.

Not many notices giving detailed plans for the 1923 Management Week have yet reached the office of the Taylor Society. One of the most interesting among those which have been received is the Columbus, O. program. Under the auspices of the College of Commerce and Journalism of Ohio State University a three-day conference is to be held in Columbus on October 24, 25 and 26. Round table sections of the conference have been organized for consideration of Industrial Costs, Production Control in Industry, Materal Control, Problems of Market Analysis, Foreign Trade and Coal Storage. We have yet to learn of any local organization which has found in Management Week such an opportunity for service to the community as is evidenced in the programs of the Columbus group.

THINKING is a natural thing, just as natural as breathing or nutrition. This means that one does not learn to think any more than he learns to breathe or to assimilate food. No one can learn to live, he can only learn to live *well*. The thing is true of thinking. You do not learn to think; what you learn to do is to *improve* your thinking.—McClure: *How to Think in Business*, p. 6.

NEWS OF THE SECTIONS

Plans for the Year—Fall Programs

THE New York Southern Tier Section started its 1923-24 activities with a joint meeting with the Industrial Relations Association, Elmira District, at Elmira, September 12. The Managing Director of the Society spoke on "Industrial Tendencies and the Management Problem."

The next five meetings will be given up to roundtable discussion of these topics: 1. Standards; 2. General Accounting as Related to Production Control; 3. Cost Accounting as Related to Production Control; 4. Overhead Distribution; 5. Production and Stores Control Boards.

The Central New York Section held no business meetings during the months of July and August, but in July had an outing, followed by a dinner at Three Rivers, New York, in conjunction with the Central New York Purchasing Agents' Association.

The first regular business meeting was held September 31 at Utica, New York. The session opened with an informal luncheon at the Utica Country Club, and the afternoon was spent in visiting various industrial plants in Utica, including Bossert Corporation (Metal Stampings), Divine Bros. (Buffing Wheels), Foster Bros. (Metal Beds and Springs), International Heater (Stoves and Heaters), Mutual Box Board Co. (Card board), Savage Arms Corporation (Arms and Washing Machines), Utica Cutlery Co. (Knives), Utica Duxbak Corporation (Trousers and Hunting Clothes), Utica Knitting Co. (Knit Underwear), and West End Brewing Co. (Soft Drinks). At about five o'clock in the afternoon the Section and guests met at the plant of the Foamite-Childs Corporation where outdoor and indoor demonstrations of the effectiveness of Foamite were given. After the demonstrations the Foamite-Childs Plant was inspected, followed by an informal dinner in the plant cafeteria. The company orchestra furnished entertaining music and accompaniment for the singing in which the Section and its guests indulged.

Following the dinner and a very brief business meeting, Dr. H. S. Person, Managing Director of the Society, gave an address on Industrial Tendencies and the Management Problem.

The next meeting of the Section will be held in Syracuse, probably at the Chamber of Commerce rooms, on Friday, October 26th, and will be preceded as usual by an informal dinner at 6:30. Inasmuch as this meeting will be the annual meeting for the election of officers and transaction of general business, no paper will be presented, but there will be informal round table discussion of topics of interest.

It is planned to hold meetings each month during the winter at Syracuse, probably the last Friday of each month. Among the subjects scheduled for discussion are a case presentation of continuous employment resulting from balanced production and sales, and a case presentation of sales engineering and sales planning.

It is also planned to extend the service of the Section through a question department which will encourage members to present their problems in writing, while the solution will be given, if a solution is found, at a regular meeting. If beyond the scope of the local section the questions will be referred to the parent society.

The Cleveland Section will open its winter season during Management Week with meetings Wednesday, Thursday and Friday, October 24, 25, and 26. On Wednesday Colonel E. C. Peck will read a paper on "Standardization in its Relation to Management." The next two days the participating sections join with the Society of Automotive Engineers who are holding their annual convention in Cleveland and are making a Management Week function of it.

The program for the balance of the winter is being prepared and will consist of definitely assigned topics for definite days monthly throughout the winter.

Over sixty members and guests attended the luncheon meeting of the New York Section at Cafe Boulevard, October 4. The paper presented by Mr. W. H. Leffingwell is printed in full in this Bulletin.

A committee consisting of C. L. Pearson, Chairman; F. E. Goltra, H. Ortman, D. J. Walsh, John Williams and Ruth Reticker was oppointed to draw up a program for the year.

The Chicago Section is planning to continue this fall its systematic study of cases illustrating management principles. Early in 1923 this section undertook a study of investigation and analysis, and followed this by a study of examples of standardization. This fall's program now being organized by the Program Committee, Hugo Diemer, chairman, will center about the subject of Control, beginning with Materials Control.

This month the section is concentrating on Management week activities, including a meeting of the cooperating organizations Monday night, October 22, at the Western Society of Engineers, on the general topic

"Mechanical Methods of Increasing Man Power;" a special meeting Wednesday at the Association of Commerce; and a meeting Thursday evening at which a representative of each of the participating societies will speak on the general subject of "Non-mechanical Methods of Developing Man Power."

THE NEXT MEETING

THE Society plans to experiment with a change in date of the first meeting of the year by holding it in January instead of in November or December. There are several reasons for the experimental change; one is the nature of the program being organized, but several impelling ones relate to conflicts or near-conflicts with other meetings which are of interest to many members. The time was when the Taylor Society meeting could be held the same week as the A. S. M. E. meeting, thereby making practicable one trip to New York for the two meetings. Now that the A. S. M. E. meeting occupies all of one week (the first week in December) such a juxtaposition is impossible, and trips in two successive weeks are impossible. Later in December is impracticable, the last week in November is Thanksgiving week, and an earlier week in November is difficult for this year at least. So look for an announcement soon of the program of the January meeting.

MEMBERSHIP CAMPAIGN

A Continuing Affair—Results to Date—The Smaller Districts in the Lead—Cleveland Leads Metropolitan Districts.

OF a society like the Taylor Society, a membership campaign must be a continuing affair. The Society attempts to offer only a substantial commodity; it addresses itself to the executive mind; it does not appeal to the emotions. Its prospect is the hard-headed, thinking executive. Therefore it cannot utilize the method of jaz and hip-hip-hurrah. It must build up its clientele by the deliberate and patient method of the bond salesman; not by the method of the patent medicine vendor.

The membership campaign inaugurated last winter had not got fairly started when it had to be suspended for the summer months. Some districts were slower than others in organizing; other districts which effected an early organization met severe weather conditions; in general, conditions made the work of last winter preparatory rather than productive of results. The following table therefore should not be taken too seriously; it represents an accounting for the early stage of the campaign. It does not give the total membership increase during the campaign period; only that reported as the result of organized effort:

District		No. of New Members	Percent of Quota
5	Mass.—Framingham	12	150.
K4	Mich.—Muskegon	2	100.
E4	N. Y.—Upper Hudson Valley	2	100.
E3	N. Y.—Southern Tier Counties	14	93.3
N2	Mo.—Kansas City	2	66.6
2	N. H.—Upper Connecticut Valley	2	50.
E2	N. Y.—Mohawk Valley	1	50.
P1	Wash.—Seattle	1	50.
10	R. I.	8	40.
26	Ohio—Cleveland	43	34.4
C6	Mass.—Pittsfield	1	33.3
25	D. of C.	4	26.6
J1	Ind.—Indianapolis	1	25.
6	Mass.—Norwood Section	2	22.
7	Mass.—Worcester	2	22.
R1	Cal.	1	20.
27	Mich.—Detroit	1	20.
16	N. Y.—North Central	6	20.
17	N. Y.—Rochester	6	20.
23	Penn.—Pittsburgh	2	20.
24	Md.	2	16.6
4	Mass.—Boston	13	13.
14	N. Y.—New York City	8	7.
20	Penn.—Philadelphia	2	6.
28	Ill.—Chicago	1	1.6
18	N. Y.—Buffalo, Niagara Falls	1	1.25
D1	Conn.—Norwalk	0	0.
U1	Ga.—Atlanta	0	0.
L1	Ill.—Kewanee	0	0.
1	Me.	0	0.
9	Mass.—Conn. Valley	0	0.
C3	Mass.—Orange	0	0.
K1	Mich.—Ann Arbor	0	0.
A1	N. H.—Lower Conn. Valley	0	0.
11	Ohio—Akron	0	0.
15	Ohio—Zanesville	0	0.
21	Penn.—Reading	0	0.
22	Penn.—Williamsport	0	0.
T1	S. C.—Camden	0	0.
B1	Vermont	0	0.

The first interesting fact disclosed by this table is the prompt and effective campaigning in some of the smaller districts. Those at the top of the list doubled their membership or did even better. The second interesting disclosure is the showing of Cleveland among the metropolitan districts, notwithstanding the fact that Cleveland had hardly got started by the end of the spring season and expects to do its effective work this fall and winter. Cleveland spent much time in organization and preparation, and the value of organization and preparation is evidenced by the striking immediate results. Cleveland's organization is that of a central committee and a district committee for each of a number of districts into which the city is divided. The preparation consisted, first, of meetings in which local district members were completely informed concerning the objects and services of the Society; and, second, of the preparation of a special portfolio for local use. The portfolio,